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Export Trading.

POLITICIANS are busily engaged describing their suddenly discovered magical means for rapidly reducing unemployment. We have discussed the subject seriously and conscientiously on so many occasions that we prefer to refrain at the moment from a controversy which has been brought down to a vote-catching level. We still attach greater importance to the improvement of British trade, by sound and legitimate means than to these other "forced growth" proposals, as the means for providing work for our great army of unemployed.

Yet we have to confess that in the discussion of trade expansion measures we are getting rather tired of the use that is being made of "that blessed word" "Salesmanship." Everybody seems to know all about it excepting the manufacturers themselves who are engaged on the job! That they are saying nothing seems significant! As we have remarked again and again it is all old, so very very old, for our manufacturers and traders to be told that they don't know their business. We told them so ourselves many years ago, knowing so much better then than we do now! We quoted visitors from overseas markets, consuls, commercial attachés and trade commissioners, regarding our failure to meet the needs of potential customers in foreign markets; declared that we were beaten by the German who found his way into the buyer's household, married the favourite daughter, and so established a lasting trade connection with a big concern in South America; told them that the foreign-made little article with a pretty red label was also beating us hollow because of our British-made habit of offering a plain-looking good quality thing without the little bit of paint that made the natives dance with delight in that very desirable market in Central Africa, or China, or somewhere else overseas. As to the need of our youths all learning foreign languages and obtaining other qualifications for overseas travelling, our set of ELECTRICAL REVIEW volumes as they face us as we write, make the shelves creak through their eagerness to alight flinging open their pages to point out here and there—in scores of places: "So long ago, we told you so!" There were, as we knew, some of an earlier generation who profited by the advice then given. But of what service is it to

remember such things and to remind our readers of them to-day! Possibly very little, yet the times have changed, the markets have changed, new and stronger foreign competitors have entered the field, and above all, new generations have arisen who need to be taught practically the same old lessons. That, at any rate, is how it strikes us as we read or listen to the advice of those in leading positions to-day. Frankly, what new things have they to tell us so that the world may be overrun by high-class electrical men who have the judgment to recognise good business and the alertness and authority to seize the opportunity? We suppose it is little short of natural that it should strike many of us as strange that British traders alone are still at the bottom of the class in selling efficiency; may it not be partly due to that stupid habit of self-depreciation?

When criticisms are levelled haphazard it may be forgotten, or not even known, that in, say, the electrical world, splendid foreign trade enterprise and organisation mark the operations of certain big concerns, and they don't want to be told much about salesmanship overseas, for they've got the men, they've got the goods, and got the money too—this last allusion being to their ability to finance big operations. Such concerns with specialised properly qualified salesmen may well take exception to the tendered advice that principals ought to go abroad, because they can already afford to pay good men and arm them with authority for action. Some of the companies that are now regarded as small, by comparison, but a few years ago would have been counted big, could a glorious tale unfold of trading enterprise abroad if they did not fear to blush or to give away their secrets; they have either gone, in the person of their head, if they have had a good second to leave, or perhaps a partner or a director has made the tour—but every business must decide for itself whether "the head" or other important man can do better abroad than at home. After all, there are important duties requiring that the head or heads shall be at home, especially in these days. The body of manufacturers who have either gone or have sent delegates to Russia recently have found no difficulty in settling that question. Possibly some manufacturers have not attended to foreign trade affairs quite so energetically as they would have done if they had relied less upon a belief that they could gain benefit from the concerted action of central organised associations. We have heard of manufacturers who expect no good to come from such sources at present, and are convinced from experience of the greater benefit that has come from the exercise of personal initiative or individual enterprise; but there is ample room for concerted co-operative action of smaller concerns suitably grouped and thus able to bear the cost.

The changes that are taking place among electrical men on the "road" at home are releasing experienced salesmen who might do good service overseas if other firms cared to give them the chance.

The head of a well-known engineering company recently advanced a proposal for the Government to provide half-a-million sterling to advertise British goods overseas. It is hardly surprising that the suggestion has fallen flat. Suppose that the Government had favoured the idea and wanted to control the spending of the money! Is it better qualified than the private trader to decide the most appropriate place and form for his advertisement, or to choose the most suitable business-getting trade papers, circulating to the right men overseas? We emphatically say "No!" A more appropriate thing for the Government to do would be to make generous allocations for increasing the efficiency and usefulness of the Department of Overseas Trade, not instead of private effort, but supplementary thereto. It might well be reorganised with the addition of a definite electrical and engineering staff of experts who can visit the various overseas markets for the preparation of expressly electrical and expressly engineering reports which the industry at home can use in connection with its expansion efforts. We have no wish to detract from the importance of the service rendered by some officials, but we certainly believe that if the Department were to send a few real live and energetic electrical and engineering men about the world, either supplementing, or co-operating with, the work of Trade Commissioners, more genuine and business-getting help would be rendered than is obtained from the peripatetic wanderings of officials at home telling us things that we have been told a thousand times before.

Labour Conditions in France.

But for the topsy turvydom which appears to exist in everything that concerns ourselves and our neighbours on the other side of the Channel there would be cause for some amazement at the difference which exists in the relative conditions of labour only a few hundred miles away. While in England it is impossible to find enough employment for our workmen, the difficulty in France is for industry to find sufficient labour for its requirements, for it is safe to say that in France there are at least two employers ready to accept the work of every good workman available, whether winder, adjuster, mechanic, or skilled in any other technical trade. Without the foreigner it is certain that many French industries would suffer severely. In the iron mines of the Sarre and Ruhr districts, for example, the foreign workers amount to eighty per cent. of the total. In the north and east the Belgians, Poles and Italians are practically indispensable in all the metal-working industries, while in the west it is the Spaniard who is invaluable. The Frenchman is industrious, but France is a large country, and the call of agriculture is imperative in a land where small farmers are so numerous. Outside the larger cities the Frenchman is a peasant, and in some districts skilled welders and solderers, for instance, are unobtainable. The consequence is that the number of French workers is totally inadequate to meet the demands of industry when trade is moderately brisk, and it is recognised officially that in years to come this question will grow in importance and will surpass all others connected with the economic future of the country. Two years ago, when French trade and finance were passing through crises which threatened the economic existence of the nation, fears were entertained in practically all quarters that the foreigner would oust the Frenchman from his employment, and steps were taken by the Government at the instigation of some of the socialist members to reduce the number of foreigners in France by creating difficulties in the maintenance of their *cartes d'identité* and by letting foreigners understand that their absence was preferred to their presence. The consequence was that although a large number of foreigners entered France during 1928 the number who left the country was still greater. It is now recognised that this was a grave error, and efforts are being made to induce the foreigner to return, and, if possible, to bring his family with him so as to increase ultimately the French population, for although the children of a foreigner born in France have the right to choose their nationality, his grandchildren, also born in France, are compulsorily French. In one labour bureau in Paris the number of demands from employers during last January amounted to 6,500, whereas the number of introductions which could be made amounted to only 1,660, and this at a period of the year when the building trade and agriculture are slack. It is feared that it will not be easy to attract the quality and quantity of labour desired, men skilled in electrical and metallurgical operations, for although employers are improving their conditions of pay and remuneration by housing accommodation, facilities for the purchase of necessaries, medical attendance, and so on, the average wage of a good workman is only five to seven francs an hour—high rates for France—which is equivalent in England to only 10d. to 1s. 2d. This is not sufficient for a foreigner who is unaccustomed to French market prices and customs, and perhaps to the

language also. However, attempts are being made to encourage the immigration of workers, and as a beginning the public are asked to recognise the foreign workman as a necessity, and not as a competitor of national labour.

Architectural Lighting.

Methods of lighting variously described as "architectural," or "modernistic," have excited much interest recently, and the paper on this subject read by Mr. W. Maitland at a recent meeting of the Illuminating Engineering Society, and abstracted in our last issue, was opportune, following his work of assisting to re-arrange and add to the display of systems and appliances for correct illumination which are exhibited at the London Lighting Service Bureau with the aid of the Electric Lamp Manufacturers' Association.

The chief feature of this method of lighting is that it forms an essential part of the architectural decoration. Ordinary chandeliers, and the like, are replaced by lighted panels, lintels, cornices, &c. Sources of light are completely concealed from view, either by means of translucent glass, or by opaque materials (as in cove and cornice lighting). An obvious good feature of this mode of lighting is the elimination of glare. A possible limitation is that in many cases the consumption of electricity is inevitably high, though admittedly the commercial advantage of obtaining striking lighting effects often more than compensates for the extra expenditure involved. This fact is illustrated by numerous Continental installations in restaurants, shops, &c., some of which are lighted on a very generous scale. It is too early as yet to forecast the future of this style of lighting, though it seems to us that the basic idea—that in this electrical age the provision of artificial light should be taken into consideration in the design of buildings—is sound. How far these ideas can be developed into the highest form of creative art remains to be seen. The creations of architects in the past were intended to be viewed exclusively by daylight. Will this conception continue, or may we expect that in the future appearance by artificial light will be considered equally important? The discussion on the subject has revealed a general feeling that inspiration in this new field of lighting should come mainly from the architectural side. We hope that everything possible will be done to interest architects in this conception of lighting, for their guidance is essential to its full development.

International Finance.

The efforts at world-wide expansion which are being made by powerful financial interests in the United States in the direction of the acquisition of the control of electricity supply and other undertakings in different countries are now attracting general attention. Apart from Europe and the Far East, the American corporations concerned are viewing with increasing favour the prospects of development in South America. Besides the great undertakings which were formerly originally established by the Germans with headquarters at Buenos Aires, and which under the treaty of Versailles were disposed of and are now vested in a Spanish company (the "Chade"), the Swiss Motor Columbus Company, of Baden, Switzerland, has large and growing interests in South America. The directors have just announced that they have rejected enticing offers for the purchase of their interests, but in order to provide guarantees against the contingency of any such group obtaining a majority control over the company, the directors have now decided to create a special type of "C" share of low denomination. It is proposed to increase the share capital from 75,000,000 fr. to 93,500,000 fr. by the issue of 10,000,000 fr. in the form of "A" and "B" shares and 8,500,000 fr. in the shape of "C" registered shares. The directors consider it their duty to see that not more than one-third of the whole share capital passes into the hands of foreigners, and for this purpose they are authorised in certain circumstances to make uniform reductions in foreign subscriptions in the necessary measure. The new "A" and "B" shares will be acquired by a banking syndicate, which will also take over the "C" shares with the obligation to offer 75,000 of these to the existing shareholders, and the balance, including those not subscribed by old shareholders, will be handed over to a "blockading syndicate." The arrangement is said to resemble the action taken by the Swiss Aluminium Industry Company, of Neuhausen, which created a special class of share as a protection against too many shares getting into foreign ownership. The practice now being followed in Switzerland seems materially to differ from that adopted in Germany a few years ago, where shares with multiple voting rights were issued so as to achieve the same object.

A Seasonable Campaign.

Having made an effort to mitigate the terrors of spring cleaning, the British Electrical Development Association is now proceeding to help members of the public to help themselves by installing electric radiators and water-heating apparatus.

No better month than April could be found for this purpose, as has already been proved by the current month. Although April days are generally warm enough to enable fires to be dispensed with (there are, of course, many exceptions to this rule), the mornings and evenings are often very chilly. It is too much trouble to light fires on that account, and that is where the electric radiator proves its worth.

As the weather gets warmer, the fire in the kitchen range makes the place unbearable, but the hot-water supply is dependent upon it. The only satisfactory substitute for the domestic boiler is an electric water heater, and there should be a good market for it where the electricity supply authority offers an economic rate for the purpose—and we are glad to say that a great many supply undertakings have realised the potentialities and have instituted special water-heating charges.

Aluminium and Copper Prices.

The recent advance in the price of copper has naturally interested producers of aluminium. Last year the price of the latter metal was reduced by agreement among the producers in Europe, by about 10 per cent. so as to stimulate the use of aluminium for still further purposes. Now, with the great rise in copper before them, the idea is growing in interested European aluminium circles that advantage of the situation should be taken by increasing prices. Until recently the price of aluminium was dearer than that of copper, but the relation has now been reversed and aluminium was lately about 17s. per cwt. lower than copper, this leaving out of consideration the advantages of the latter from the standpoint of greater conductivity, elasticity and from other points of view. The producers of aluminium, however, now seem to believe that the advantages of aluminium so greatly surpass those of copper that an increase in prices can be made without any fear of this having an unfavourable effect on the sale of aluminium. In connection with this matter, it is reported that a preliminary meeting of the committee of the European Aluminium Syndicate met in Paris on March 25th to consider the question and that meeting was to be followed by a new conference of the members of the syndicate on April 19th. It is stated that the amount of the increase will not by a long way represent the present difference between the prices of the two metals, as it cannot be known what course copper prices will take in the future, and it is not desired to destroy the incentive to an increased consumption of aluminium. In the meantime, by propaganda and by other means, every effort is being made in Germany to promote the consumption of aluminium.

A Control-gear Manufactory.

A Visit to the Works of the Igranic Electric Co., Ltd., at Bedford.

IGRANIC ELECTRIC CO., LTD., has resulted from a friendship formed between two young fellow-students at college, Mr. H. H. Cutler, the founder of the Cutler-Hammer Manufacturing Co., of America, and Mr. George A. Mower, who has been the chairman and managing director of Igranic Electric Co., Ltd., from its formation. These gentlemen, more than thirty years ago, introduced simultaneously to the American and British markets, it is claimed, the first completely standardised range of electric motor controlling apparatus. At first, the British business constituted the electrical department of the Sturtevant Engineering Co., Ltd., of which Mr. Mower was, and still is, the chairman. In 1905, the Adams Manufacturing Co., Ltd., was formed to further develop the business in these specialities. A factory was built at Bedford, in which the manufacture was continued under the trade mark "Igranic." In 1913, the Igranic Electric Co., Ltd., was formed; it took over the Bedford factory, which it greatly enlarged. Since 1913, the business has increased enormously, and the range of manufactures has been considerably extended. The range now includes magnetic aids to industry, such as lifting magnets, magnetic separators, magnetic clutches and brakes, as well as newspaper dispatch conveyors and magazine reels. The manufacture of radio apparatus has also been added to the activities of the company.

Fig. 1.—General View of Machine Room at Bedford.

The ground occupied by the works at Bedford is 6½ acres, the actual building space covered being 3½ acres. The number of hands employed is approximately 750. Fig. 1 is a view in the main machine room. The whole of the works and offices is illuminated electrically, and the total power used for electrically driving the works machinery is approximately 340 h.p. Three-phase squirrel-cage induction motors are mostly used. An electricity supply is taken from the Bedford Corporation electricity works at 6,600 V, and is transformed down to 400 V for power and 230 V for lighting The equipment in the works sub-station includes a 200-kVA, 6,600/400-V, three-phase oil-cooled transformer, and a 75-kVA, 6,600 V to 220 V three-phase oil-cooled transformer.

The motor power, at 400 V, three-phase, is taken through a main circuit breaker and a wattmeter, and then to six triple-pole switches and fuses from which six-wire armoured paper cables carry it to the distribution boards in the works, from which subsidiary cables are taken to the various motors and points of consumption. The lighting cables are taken through twelve s.p. switches and fuses, and as far as possible the whole works lighting is broken into three main groups, one on each phase.

A 50-h.p. motor-generator set is installed in the works "power station," and consists of a 400-V, 50-cycle, 50-h.p. three-phase squirrel-cage induction motor of the "Parkinson" type, coupled to a 35-kW, 220-V d.c. generator (Lancashire Dynamo & Motor Co., Ltd.) and one 35-kW, 220-V d.c. "Crompton" generator. The set is controlled by a standard "Igranic" push-button remote controller. The d.c. switchboard for this set consists of the necessary d.p. switches and regulator, while a change-over switch is provided to allow the generator or rectifier to be connected to the bus-bars. A mercury rectifier sub-station is installed, and the equipment, complete with bulbs and potential transformer, choke coils, and so on, was supplied by the Hewittic Electric Co., Ltd.; the automatic control panels for voltage regulation and current control were built in the Igranic Co.'s shops. Fig. 2 shows the "power station."

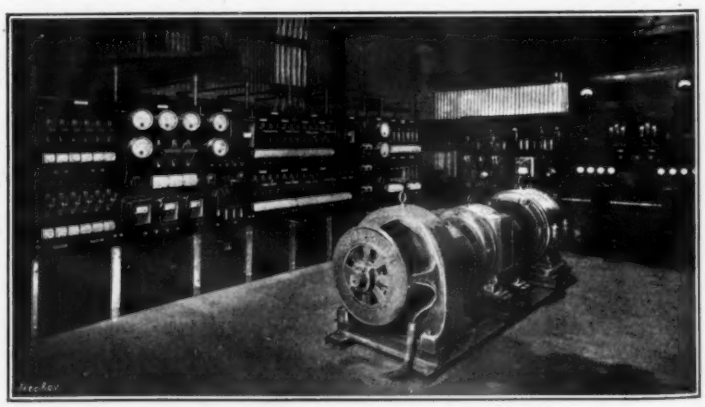


Fig. 2.—Works "Power Station."

During a recent visit to the Igranic works, several very

interesting equipments well worthy of note were seen passing through various stages of manufacture. One of these items was a newspaper dispatch conveyor of the type recently installed in some of the largest newspaper press rooms in this country. These conveyors are designed to take the newspapers direct from the folder of the press, to carry them in a continuous stream to the tables in the publishing room, and there deliver them at the rate at which they are being produced by the press, right side up, with the count indicated by "kick" copies. As the conveyor is normally driven from the press itself, the speed of delivery is at all times equal to the rate of production by the press. An auxiliary motor drive is provided merely for the purpose of clearing the copies remaining in the conveyor at the moment at which the press stops. Fig. 3 shows three newspaper press controlling equipments constructed for the London *Daily Express*. The power units are of the usual worm-geared pony-motor type, rated at 110 h.p. continuous output. The panels give full push-button control of the printing presses and reel stands, and are arranged so that any two power units can be paralleled as may be required.

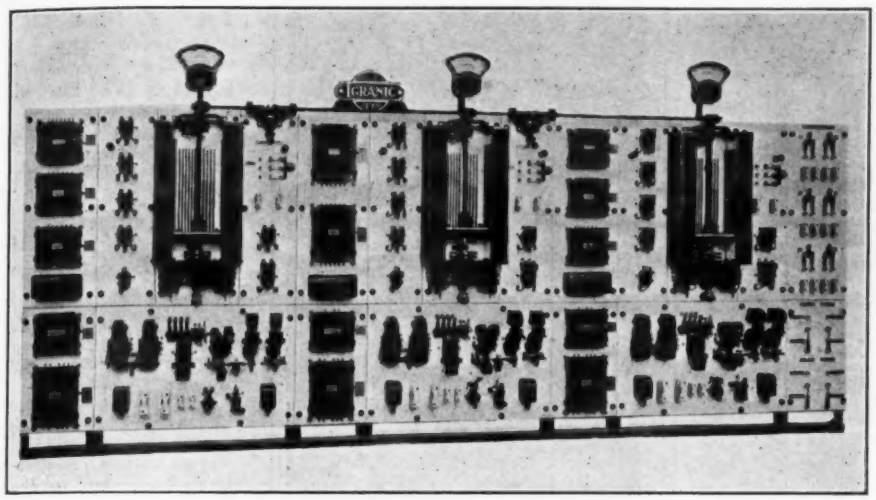


Fig. 3.—Control Equipment for Three Printing-press Drives.

Another particularly interesting item which was seen was an automatic control panel for a 150-h.p. d.c. motor driving a skip hoist for blast-furnace charging. The hoist is designed to automatically accelerate the motor and slow down and stop at the end of the travel. After a predetermined interval to allow for the load to be tipped, the hoist automatically returns, slows down and stops, ready for recharging. It is interesting to note that similar equipment is being supplied for the control of the revolving-furnace top, in such a manner as to distribute the charge evenly round the furnace, with automatic dumping and electrically-operated try-rods for indicating the height of the charge in the furnace itself. The equipment is for an important British steel works, and is the third furnace in this steel works to be equipped with "Igranic" gear.

Fig. 7 shows the control panels on ebony sindanyo bases for the double-leaf bascule bridge for the Port of London Authority at Tilbury Docks. Each leaf is operated by two 35-h.p. d.c. motors, and the panel equipment provides for full contactor control of both leaves of the bridge from a single master controller. It operates a full system of signal lights in the cabin, informing the operator of the position of both leaves of the bridge by night and day. In operating the bridge, the acceleration of the motors is automatically timed, and automatic slow-down and stopping is arranged by means of limit switches. Special care requires to be taken in closing the bridge to secure the correct interleaving of the two bascules. For this purpose, automatic gear is provided which lowers one leaf to the correct interlocking position before the arrival of the second leaf, which afterwards arrives at a dead crawling speed, and then drives both leaves together to the fully-closed position.

A control panel for two 62-h.p. d.c. motors installed for operating the grab hoist of a coaling crane at Rotterdam is shown in fig. 8. Unit clappers for reversing and acceleration are mounted on slate panels on a tubular framework, and full provision is made by a system of relays to enable grab manipulation to be carried out by hoisting on the grab-opening and grab-closing lines, respectively, and also for load sharing between the two motors when hoisting the full grab. The equipment shown in fig. 4 provides for the full hoist control of a grab unloading crane, but in this instance the motors are a.c. slip-ring ones. As in the previous instance, full control is provided of two 165/200-h.p. motors for grab manipulation and also for load sharing by the two motors during hoisting.

Some interesting control equipments seen were for ten level luffing dock cranes now under erection by Messrs. Stothert & Pitt at the Avonmouth Docks of the Port of Bristol Authority. Eight of the cranes are of the 4-motor type, and all the motors are a.c. squirrel-cage induction machines wound with two-speed stators. Tests made on site suggest that the operation of these cranes will be very successful.

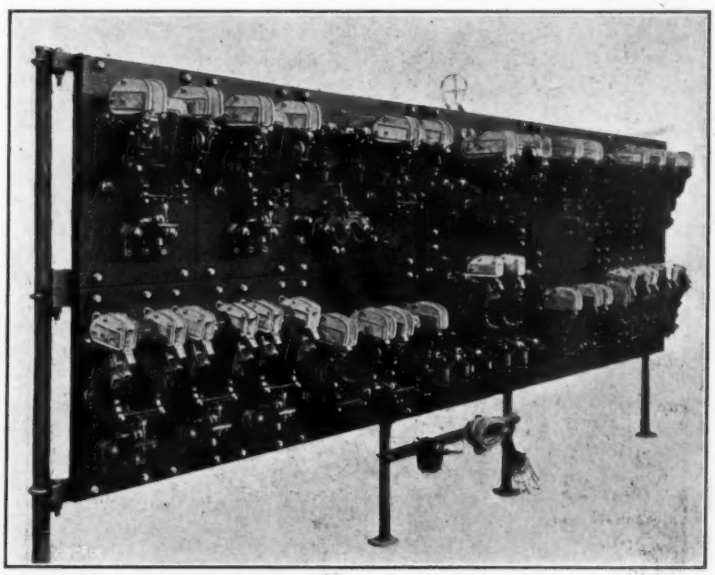


Fig. 4.—Controller for Crane Equipment, with A.C. Slip-ring Motors.

Fig. 6 shows a control panel made by the Igranic Co. to the order of the British-American Laundry Machinery Co., Ltd. The feature of this is the drum-

switch control of the contactors. The board has provision for a laundry unit, at the top. For future units additional equipment may be mounted on the lower panels and the drum switch extended downward without disconnecting or interfering in any way with the existing apparatus. Some interesting examples were seen of a line of automatic starting pillar panels recently developed by the Igranic Co. These are made in three sizes, A, B and D, for all voltages up to 550 V. The "A" and "B" panels each comprise a self-acting motor-starting rheostat of the multiple-finger type, and a double-pole magnetically-operated circuit breaker. The "D" type panel employs a multiple-finger self-acting starter, two single-pole mechanicallly-operated switches, one of which is used for the opening and closing of one pole, while the other is employed for short-circuiting the multiple-finger starter after all the armature resistance has been cut down. Overload protection is provided for by a time-limit device, and a "start and stop" button is fitted in the panel housing. A pediment ammeter may be added to either type of panel.

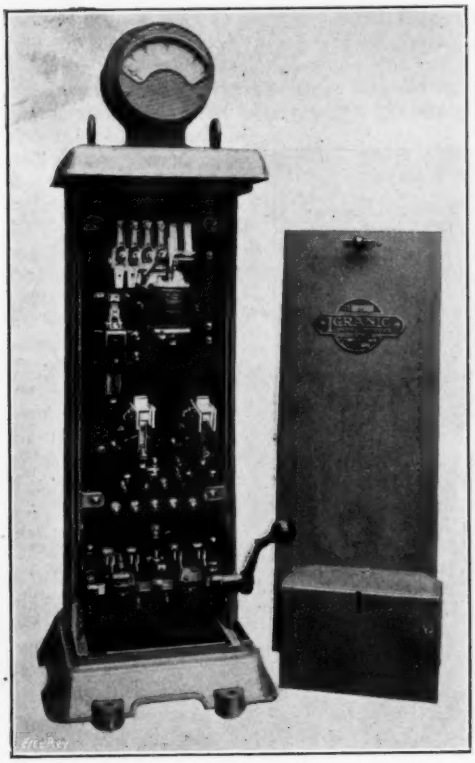


Fig. 5.—"A" Automatic Pillar Panel; Front Lifted Out.

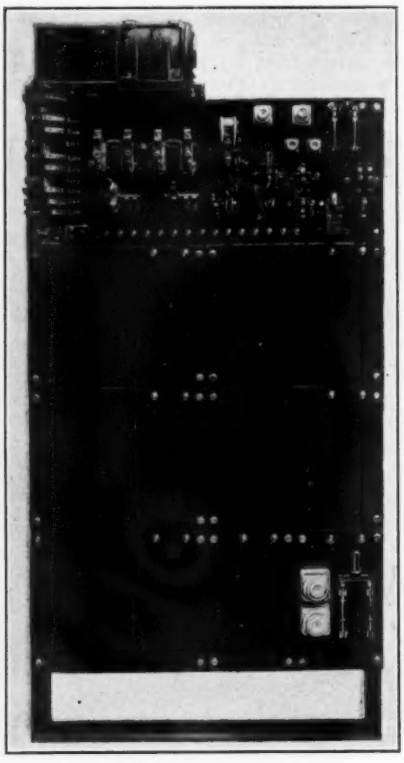


Fig. 6.—Panel with Provision for Drum-switch Extension.

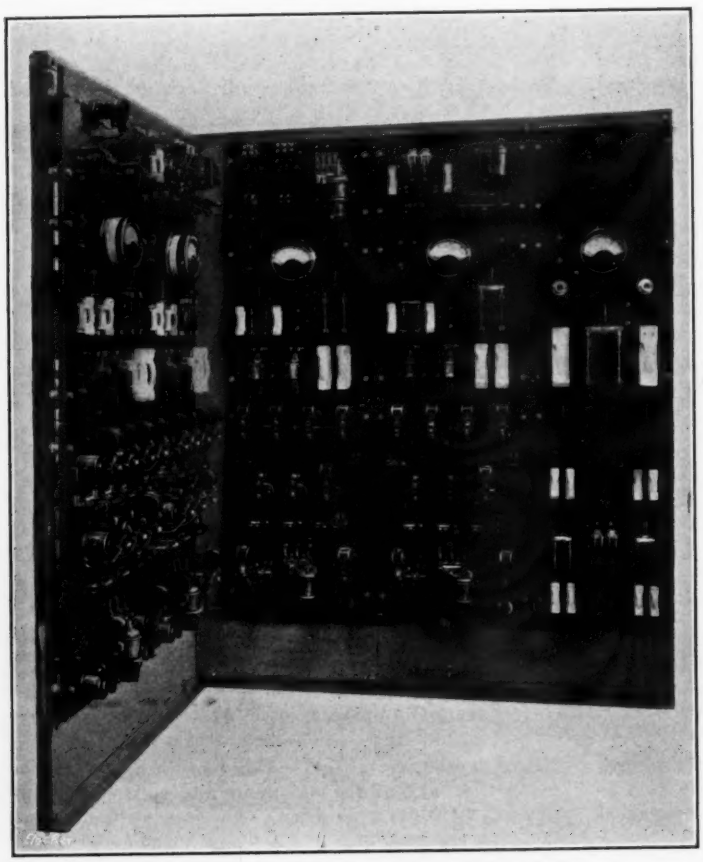


Fig. 7.—Control Panels for Tilbury Docks Bridge.

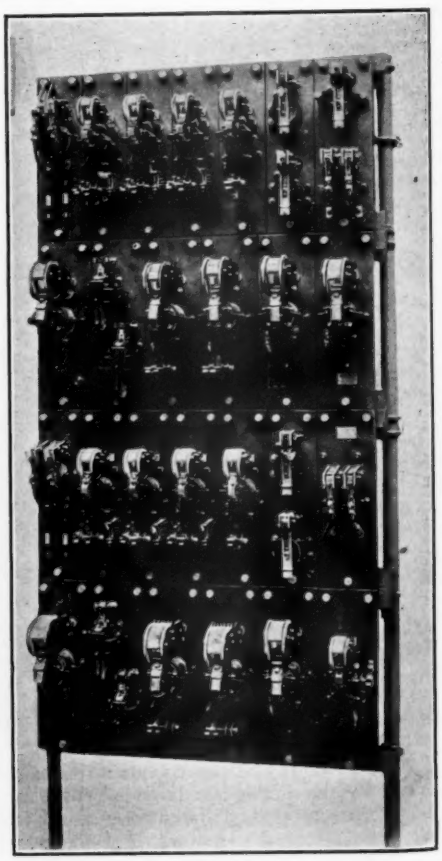


Fig. 8.—Coaling Hoist Control Unit.

and also an interlocked double-pole isolating switch accommodated in a separate compart-

ment. The housing is a strongly-made iron and steel pillar, which entirely encloses the switchgear and effectually protects it from mechanical injury as well as from the weather. Efficient ventilation is provided. The feature which distinguishes the housing is the easy and perfect access which is afforded to the whole of the contents of the pillar without the necessity of dismantling. The panel is not built in the housing, but is placed therein as a unit, complete with all its switchgear, resistances and interconnections. It is built on a strong iron frame and in no way depends upon the housing for support. The pillar is split vertically down the sides, so that the front can be entirely detached from the back. The front can be quite easily let down or lifted right off, as shown in fig. 5. Access to the back of the panel is gained by simply freeing two latches at the top and pulling the panel forward, in which position it is held by two slotted steel straps, one at each side. If necessary, these two straps can be easily unshipped, the leads at the bottom of the panel disconnected, and the whole panel, with its resistances, can be lifted entirely out of the housing.

When an isolating switch is furnished this can be opened and closed by means of an external operating handle. The front portion of the main housing is so interlocked with the isolating switch in the lower chamber that whilst the upper portion of the panel remains open the isolating switch cannot be closed. When the isolating switch is open, both the motor circuit and the control circuit are disconnected on both poles, so that during examination every part of the panel is "dead."

The self-acting motor starter is solenoid operated, the solenoid plunger being controlled by a dash-pot, so that the time for cutting out the starting resistance can be varied by adjustment of a small screw on the side of the dash-pot. A number of contact fingers for cutting out the sections of starting resistance are actuated by a revolving shaft which is operated by the solenoid plunger. The whole of the starting equipment is mounted on an ebony sindanyo base, which, it is claimed, is superior to slate and is suitable for use in all climates. The armature resistance, which is liberally rated, is supported at the rear of the sindanyo base. The usual features of "Igranic" ordinary starters, such as porcelain insulation, bare connection wires, solderless mechanical joints, and so on, are embodied in the new apparatus. The equipment may be adapted to many special purposes, including pump control and pressure regulation.

Mention should be made of the "Igranic" transverse current microphone, a recent development of the company, which is designed to respond uniformly to sound waves of all frequencies and with complete freedom from background noises. The feature of this device is that the path of the current is at right angles to the plane of the diaphragm, so that sound waves impinge on the diaphragm at right angles to the direction of current flow. It is possible to employ in the microphone a diaphragm which is a non-conductor and which, therefore, can be made practically non-resonant, so that it responds evenly to notes of all audible frequencies. Interspersed between the two electrodes are several compartments, each containing carbon granules of a size different from those in the other compartments. Each group of granules responds to one band of frequencies more than another, and in this way the grading of the carbon granules into groups of various sizes ensures that all frequencies are dealt with uniformly. The combination of this principle with the use of a non-resonant diaphragm enables, it is claimed, particularly excellent results to be obtained.

Changing Over to A.C.

Notes on the methods of dealing with consumers' apparatus and service equipment adopted by a large electricity supply undertaking during the alteration of the distribution network from the d.c. to a.c. system.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

(*Concluded from page* 606.)

Battery Eliminators.—Every supply engineer engaged on changing a d.c. network over to a.c. to-day will confirm that, had it not been for the popularity of wireless in the home, little or no apparatus would have required alteration or changing. During the last twelve months, anode battery eliminators, especially those working off d.c. mains, have grown enormously in popularity. It is not, perhaps, generally realised that a d.c. eliminator working the average 3-valve set takes only about .015 ampere, and, since this does not work the meter (electrolytic types excepted), this service is, therefore, given free by the supply undertaking. Now, there are good, bad, and indifferent d.c. eliminators in use to-day, not only in their performance, but also in their intrinsic value. At one time new a.c. eliminators were given in exchange for consumers' existing d.c. ones, but this was quickly stopped for two reasons. In the first place, the man with a poor eliminator, costing a few shillings, was treated to a good, reliable a.c. one, just in the same way as the man who had paid a good price for his, which, of course, was manifestly unfair. Secondly, a.c. eliminators are expensive, being at least double the price of the d.c. type. So it was decided to install an a.c. rectifier and leave the consumer's existing eliminator in his possession. This means that if a consumer had a poor eliminator on d.c., he still retains it when the supply is changed to a.c., and likewise with the man who had purchased an efficient and comparatively expensive one.

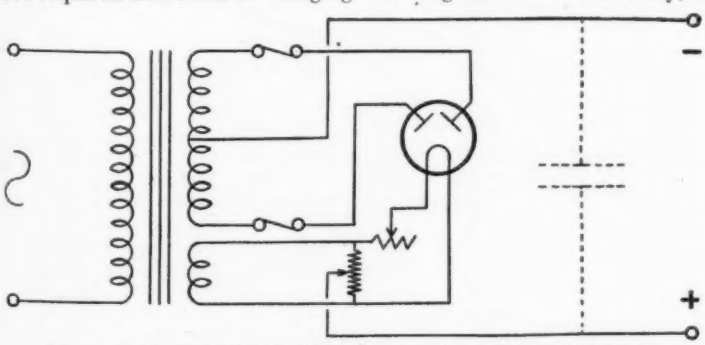


Fig. 2.—Thermionic Rectifier for Anode Battery Eliminator.

Such rectifiers can be of two types, either thermionic or metallic. With regard to the first type, a trans-

former being essential in its construction, this automatically isolates the whole of the consumer's wireless apparatus from the supply mains, and thus conforms with the I.E.E. Wiring Regulations. On the other hand, if a metal rectifier is employed, in most cases it is not necessary for a transformer to be used from a purely operating point of view, but it is most desirable, in that the vast majority of wireless sets working off d.c. mains have many exposed parts which are alive, besides the lurking danger consequent on a breakdown of the insulation of head-phones or loud-speaker circuits, which is always present without the provision of some form of isolation, such as a double-wound transformer between the 'phones, or speaker, and the output terminals of the set.

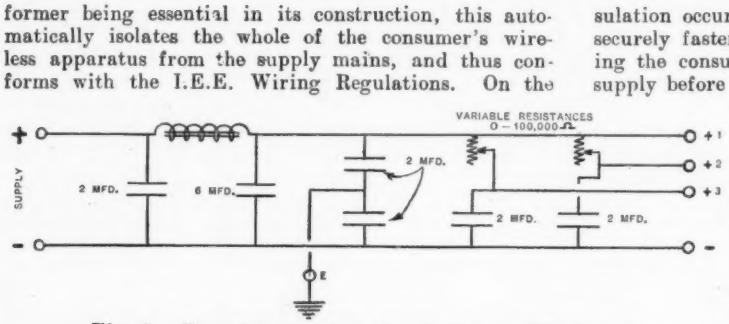


Fig. 3.—Experimental D.C. Anode Battery Eliminator.

A typical valve rectifier for use with a d.c. eliminator is shown in fig. 2. The a.c. supply is 230 volts, 50 cycles. This is intended to be utilised with eliminators working on 220 volts d.c. The load characteristics of this is shown in fig. 4, and those of a metal rectifier in fig. 5. These rectifiers are simply connected between the source of supply (usually a plug-socket or lamp-holder) and the eliminator.

On some occasions when a rectifier is installed, a rather prominent mains-hum is emitted from the loud-speaker. The consumer, of course, always states that this was not present before the change in the supply was effected! And since the supply cannot, obviously, be changed back again to d.c. in order to prove this, the supply undertaking has to give the benefit of the doubt in this matter to the consumer. This can usually be overcome by connecting a capacity, totalling a few microfarads, across the output terminals of the rectifier.

These rectifiers should be enclosed in stout metallic casing, bonded to the transformer core and equipped with an earthing terminal which is connected by means of a cable not less than 7/.029 to a convenient earth—not the wireless earth which is liable to be removed or interfered with—in order to prevent danger of shock should a breakdown in the insulation occur. The covers of such rectifiers should be securely fastened down, and fitted with a label warning the consumer to disconnect the rectifier from the supply before attempting to remove the cover. This is very important, because in the case of valve rectifiers employing full-wave rectification, the mid-tapped secondary coil of the transformer has a pressure of the order of 500 volts a.c. across the terminals at its extremities.

Sometimes when a rectifier has been installed the consumer is not at all satisfied with the results obtained, compared with the alleged perfect radio reception when the supply was d.c. And when it is mildly pointed out that the fault may possibly be in his own eliminator, this is usually hotly denied on his part, and the supply undertaking's rectifier is indicated as being the undoubted cause of the trouble. At this juncture it is often worth while to see if some slight adjustment of the receiving set, such as the correct grid bias to the various valves, will put matters right. If not, the consumer's d.c. eliminator is removed, and a test d.c. eliminator (see fig. 3) inserted in its place. The voltages on the anodes of the various valves are adjusted to their correct value and usually everything is then O.K. By this means it can be demonstrated to the consumer which is the apparatus at fault—his own or that supplied by the undertaking. Incidentally, this testing eliminator is also a most useful piece of apparatus in connection with the ordinary routine work of the supply undertaking on those parts of the network which remain on d.c., in that it can be utilised in investigat-

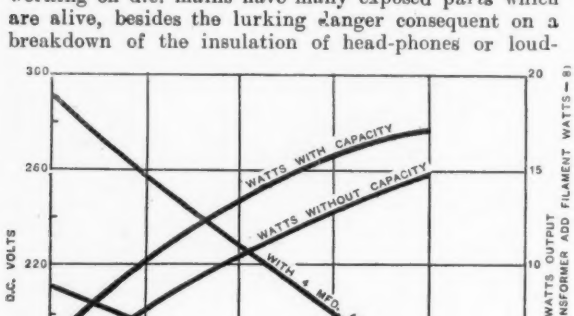

WATTS WITH CAPACITY
WATTS WITHOUT CAPACITY
WITH 4 MFD. ACROSS D.C. OUTPUT
WITH NO CONDENSER
D.C. VOLTS
WATTS OUTPUT (FOR OUTPUT OF TRANSFORMER ADD FILAMENT WATTS – 8)
D.C. OUTPUT CURRENT IN MILLIAMPERES

Fig. 4.—Load Characteristics of Thermionic Rectifier.

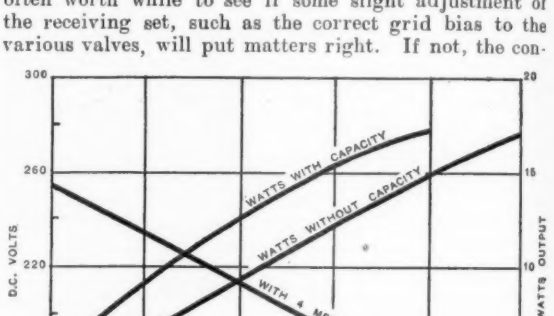


Fig. 5.—Load Characteristics of Metallic Rectifier.

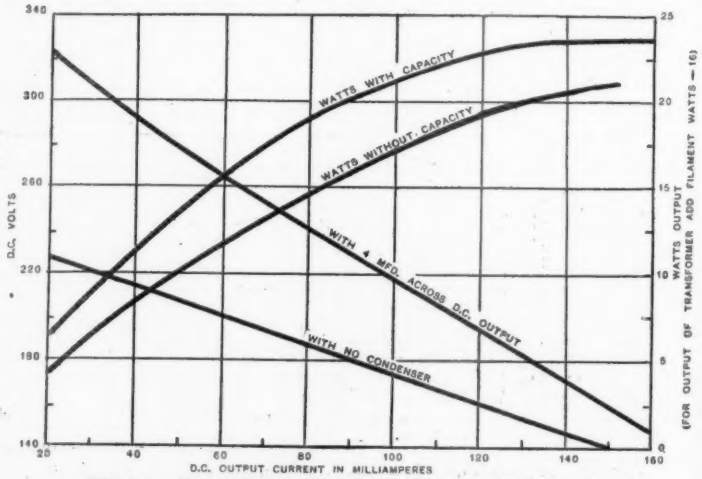

WATTS WITH CAPACITY
WATTS WITHOUT CAPACITY
WITH 4 MFD. ACROSS D.C. OUTPUT
WITH NO CONDENSER
D.C. VOLTS
WATTS OUTPUT (FOR OUTPUT OF TRANSFORMER ADD FILAMENT WATTS – 16)
D.C. OUTPUT CURRENT IN MILLIAMPERES

Fig. 6.—Load Characteristics of Rectifier for Combined L.T. and H.T. Eliminators.

ing complaints of interference with wireless reception, which is the latest burden laid on the shoulders of the supply engineer.

Occasionally, one comes across a consumer who utilises the full d.c. outer pressure, of the order of 440 volts, for the anode voltages of his power valves. For this purpose a valve rectifier should not be considered, because round about 1,000 volts a.c. across the secondary terminals of the transformer would be necessary, and such a dangerous pressure is most unwise in a private house. Metal rectifiers also are somewhat costly for such a voltage. The cheapest and safest method is to obtain a 440-volt anode accumulator, with the necessary charging apparatus, already referred to. This takes up a good deal of room, but it is by far the best proposition in the circumstances.

Some wireless receiving sets operated from d.c. mains possess combined l.t. and h.t. battery eliminators. If these are of a reputable make, it is often the wisest and cheapest plan to install an a.c. model of the same make in exchange. In the case of home-made combined l.t. and h.t. eliminators, a large rectifier, with an output as shown in fig. 6, will often be satisfactory.

Moving-Coil Loud-speakers.—The recent introduction of these requires special consideration. Their magnet systems may be energised from accumulators or fed directly from the d.c. supply mains. Since these energising coils are often wound by amateurs themselves, little is known of the actual current consumption, so it is usually necessary to insert a milli-ammeter before the change-over takes place, in order to ascertain it. Most of the currents are of the order of 120 mA. If the load characteristic curves of the various rectifiers to hand are consulted, simple interpolation will indicate the correct one for the job. Often a consumer runs both a moving-coil loud-speaker and the plate voltages of his valves from the supply mains. In such a case, one rectifier will often suffice for the two purposes. Where an energising coil has been wound by an amateur in such a way that, having a fairly low resistance, it requires a relatively high rectifier current, it will often pay the supply undertaking to have the coil rewound to the correct values to work with a suitable rectifier. If a metal rectifier is used to supply the current to the energising coil of a loud-speaker only, and not to the receiving set as well, it is not necessary to employ a transformer to isolate it from the supply mains.

Another point to be appreciated is that with regard to the measuring of the currents and voltages already referred to above, a special volt-ammeter is required. The voltmeter must have a resistance of at least 1,000 ohms per volt, otherwise serious errors will creep in, by reason of the voltmeter taking more current than the apparatus, the pressure across whose terminals is being measured. A suitable combined voltmeter and milliammeter for this purpose is the following:—

Milliampere ranges	0—12.5
	0—50
	0—500
Volt ranges	0—12.5
	0—125
	0—500

Ultra-Violet-Ray Lamps.—These lamps have become very popular, both in the home and with the doctor, of late. On changing over to a.c., the ordinary carbon-arc type is usually not affected. The mercury-arc type, however, is, of course, put completely out of action. The burner must be changed to a special a.c. type with two positive and one negative electrodes, and a transformer and one or two accessories connected between it and the supply. This alteration should, of course, be executed by the makers of the d.c. lamp. A motor-generator can, alternatively, be employed, but this is usually vetoed on the score of noise, space occupied, expense and possible interference with wireless reception. Many people do not consider the a.c. mercury-vapour lamp satisfactory, and at least one maker of ultra-violet-ray lamps of the mercury-arc type has decided to manufacture only the d.c. burner, and if this has to be installed on an a.c. supply, a mercury-arc rectifier must be connected between it and the supply mains. Such a rectifier is mounted in a neat metal case on castors, and is an excellent and economical method of solving the difficulty of converting existing d.c. ultra-violet-ray lamps of the mercury-arc type to a.c. supply. Incidentally, these mercury-arc rectifiers, having a continuous d.c. output of about 3 amperes, and capable of withstanding a starting current of 12 amperes, can often be used for other purposes in changing-over to a.c., apart from that referred to here.

There are, obviously, many other pieces of apparatus which have to be exchanged or altered to work on a.c., but those referred to above have been selected as the most common in use.

In conclusion, the author is indebted to Mr. R. A. Chattock, M.I.E.E., city electrical engineer, Birmingham, for permission to publish much of the information contained in this article.

Dew Point Measurement of Flue Gas.

A Method of Detecting Leakage from the Boiler Elements while the Unit is under Working Conditions.

By VERNON WALKER, A.M.I.E.E.

THE capacity and pressure of the modern water-tube boiler have increased very rapidly during the last few years Units capable of evaporating from 250,000 to 300,000 lb. per hour are becoming general in large stations, and pressures have increased in some cases to as high a figure as 1,300 lb. per sq. in. Water walls and screens are being extensively applied, and these render a very high combustion temperature imperative, subjecting the furnace tubes to very heavy duty. Under these conditions, it is a great advantage to be able to detect any leakage from the boiler elements while the unit is under actual working conditions, and the following notes show how this can be done by the aid of a fairly simple method. To obtain the amount of moisture contained in the flue gases escaping from the boiler or economiser, it is first necessary to ascertain the "dew point" of the gases. This enables one to deduct from pychrometric charts the amount of moisture contained in each pound of gas. It has been found that the characteristics of flue gas follow so closely those of air, that data at present available for air conditions can be used without introducing any serious error. The apparatus shown in fig. 1 for obtaining dew point has been employed on pulverised-fuel units of large capacity, for obtaining the wet- and dry-bulb temperatures. It will be seen that the gases are drawn by the aid of an aspirator, first through a dust filter made of felt or wool, which is wrapped round a fine-gauze-wire

core placed in the first earthenware jar. After passing through this filter, the gases enter the second jar in which is placed a ½-in. copper "U" tube containing in one leg the dry-bulb thermometer, and in the other the wet-bulb thermometer. A slot is cut in one of the legs of the wet-bulb tube to allow the wicking which is wrapped round the wet thermometer bulb to drop in the water at the base of the jar. This keeps the wet-bulb wick moistened, and the temperature of evaporation is therefore given by the thermometer in the usual way.

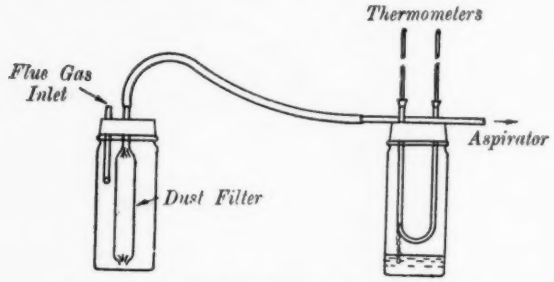


Fig. 1.—Flue-Gas Dew Point Apparatus.

The gas passes first past the dry-bulb thermometer and then past the wet-bulb one with the aid of an aspirator which should draw the gases through the tube at about 10 ft. per second. The filter and thermometer jar are placed in a box lightly packed with cotton wool or waste, in order to prevent the cooling of the gases below dew point, in which case the filter and thermometers become covered with moisture and the readings will not be reliable. The jars should be as small as possible on this account, and it is advisable to pack the box so that the tops of thermometers are just showing. The rubber stoppers should also be a tight fit in order to prevent leakage of air into the jars; these are preferably made to fit the tops of the jars. The connection to the flues should also be as short as possible if iron or copper pipe is used, and this can be wrapped with asbestos string. It is of first importance that the apparatus should not be placed in a cold or draughty place, and the gas should be drawn through the apparatus for a sufficient length of time to allow the temperature to become stabilised and the readings of the thermometers to become steady. The readings of the wet- and dry-bulb thermometers having been noted, the pounds of moisture per pound of flue gas can be obtained from the humidity charts. The next procedure is to calculate from the ultimate analysis of the coal the pounds of combustible per pound of coal, and having multiplied this figure by the coal used in unit time and by the moisture content as found by the "dew point," the result will be the actual pounds of moisture contained in the flue gases in a given time. The pounds of moisture in the flue gas from the combustion air, moisture contained in the coal, and from the combustion of the hydrogen content, are then determined for a given time. If this figure is now taken from the actual amount of moisture as determined by the "testing set," the result will be the leakage in unit time thus:—

$$\text{Boiler leak} = \frac{\text{lb. of moisture observed per unit time} - \text{lb. of moisture accounted for per unit time}}{\text{lb. of steam evaporated per unit time}} \times 100$$

It is interesting to test the apparatus by turning on one of the soot blowers, or operating a steam lance, and it will be seen that the wet-bulb thermometer instantly rises and falls almost instantaneously with the turning of the steam on or off. To facilitate the above calculations, it is handy to draw up a curve showing the amount of moisture that is contained in the flue gas per pound of coal from the combustion air, moisture from the coal and the hydrogen content, for a given CO_2 content of the gases and moisture content of the coal. The following table gives an example of the total moisture in the flue gases and the lb. of combustible from a coal having an ultimate analysis as shown. In general, the main influence is the quantity of hydrogen in the fuel, actual variations in the atmospheric conditions and moisture in the coal having a very small influence on the total moisture contained. In the example shown, the air is taken as fully saturated at 60 deg. F. and therefore contains .011 lb. of water vapour per lb.

Ultimate analysis of coal.

Lb. per lb. of coal:

Carbon .712; oxygen .0649; sulphur .024; hydrogen .0466; nitrogen .0131; ash .0824; dry air required for combustion 9.65 lb.

Maximum CO_2 18.25 per cent.

CO_2 per cent. ...	15.2	13.0	11.3	10	8.96
Excess air per lb. coal	1.93	3.86	5.79	7.72	9.650
Moisture in excess air ...	.023	.042	.063	.084	.106
Moisture in air for combustion	.129	.148	.169	.190	.212
Moisture in coal and from combustion of hydrogen	.476	.476	.476	.476	.476
Total moisture in flue gas	.605	.624	.645	.666	.688
Lb. combustible per lb. coal	12.0	13.93	15.86	17.79	19.72
Excess air per cent. ...	20	40	60	80	100

In a very interesting article in the Review* some time ago, Mr. Waite showed how "dew point" could be calculated from the volume of the flue gas and the water vapour, and it was pointed out that the "dew point" temperature is reached when the temperature of the flue-gas mixture causes the volume of gas present to coincide with the volume of the water vapour. It is therefore possible to calculate the "dew point" by making a series of curves showing the gas volume and water-vapour volume for a given CO_2, the intersection of the curves giving the desired "dew point" temperature. This calculated dew point will be found to coincide very favourably with no leakage dew point as determined by the above apparatus. Fig. 2 shows a home-made apparatus as described above, the copper piping being wrapped with asbestos string to prevent condensation. Several faulty economiser-tube ends are also shown, corrosion having occurred externally and internally.

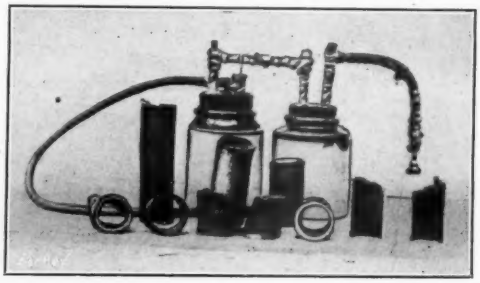


Fig. 2.—"Home-Made" Model, and Faulty Tubes.

The following figures taken on a 50,000-lb. stoker-fired unit fitted with soot blowers may be of interest.

Coal used per hr.	Dew Point apparatus of Wet	Dry	Moisture grains per lb.	Lb. per lb. air.	CO_2% at exit.	Calculated moisture lb. per hr.	Actual moisture lb. per hr.	Leakage steam lb. per hr.	Remarks.
5,500	100	117	270	.038	10	3,930	3,900	—	Boiler steaming. No steam on soot blower elements.
5,500	106	118	350	.050	10	3,930	4,800	870	Steam on soot blower system. Valve found leaking.
5,500	115	120	490	.070	10	3,930	6,800	2,870	Soot blower in 1st pass in operation (20 nozzles).
5,500	122	125	620	.088	10	3,930	8,600	4,670	Soot blower in 2nd pass in operation (28 nozzles).

* June 13th and 20th, 1924, pp. 954 and 994.

The Copper Situation.

A summary of the causes of the recent movement and a consideration of the prospects for the future.

By A. V. WILLSMORE.

THE feature of the base metals market during recent months has been the rapid rise in the price of copper. In September, 1928, the quotation for electrolytic bars stood at a little over £69 per ton. By the end of 1928 the price had risen to £75, and at present the figure is in the neighbourhood of £110 with an upward tendency. The electrical industry, as the principal consumer of copper, is naturally interested in how far this movement is likely to continue. A summary of the underlying features of the present situation may therefore be of interest.

Between 1914 and 1918 production of copper was forced up to unprecedented levels to meet war needs. After the boom years following the Armistice, however, demand fell off. This falling off in demand was accompanied by the liquidation of large Government-held stocks and the disposal of large quantities of scrap metal so that prices declined to a low level. These heavy stocks were gradually absorbed and consumption has steadily improved to such an extent that there is now a pressure on output resulting in a rise in prices. This rising tendency has been helped by the activity of the Copper Exporters' Association, an American monopolistic body acting on behalf of producing interests.

In considering the situation it is necessary to take two distinct views. Production of copper cannot be increased at short notice and a different situation exists between the immediate future and the not so near future. We will take first the probable situation over the next few months.

Recent Movements.

The recent rapid rise in the price of copper originated in October last year, when the news of an earthquake in Chile led to increased buying orders. The output was again threatened shortly afterwards by civil disturbances in Mexico and again there was an increase in demand. Up to February 23rd, however, the price had only risen to about £80.

At that time it was appreciated that world consumption of copper had increased by leaps and bounds and was growing rapidly, and in the following week the price advanced almost daily as a result of a rush to buy the metal, until a figure of £90 was reached. The demand then slackened for a while, but when the February statistics were issued they showed that as a result of increased deliveries stocks had dropped to a level representing barely ten days' requirements. This immediately led to a fresh burst of buying which has culminated in the present situation.

Present Situation.

Persistent buying has continued in the face of declining stocks; American consumption has been fully maintained if not increased; production has not yet responded to the spur of increased prices. That, in brief, is the present situation, and the outlook for the immediate future is that prices will be maintained on a high level.

Production cannot be increased at short notice, and in view of the state of affairs in Chile and Mexico, if demand is maintained at the present level a further increase in prices must be expected. There is, however, a growing feeling that American consumers are overbuying, and, although there is no reliable information concerning stocks privately held, it is believed that the purchases already made are sufficient to cover orders in hand until the middle of the year. If, therefore, consumers would be content to cover only against actual fresh orders, the situation would probably right itself by June or July.

The condition over the next few months will probably continue to be abnormal, but even when this has been straightened out it is practically certain that copper will stand at a level higher than that prevailing before the recent movement.

On the supply side, American consumption shows signs of increasing and the general demand for copper is likely to grow. Extensive electrical development schemes will mean increased consumption of the red metal (unless the high price leads to a postponement of certain projects), the motor industry in America continues to develop, and there seeems little sign of a business depression leading to reduced consumption.

Substitution.

There is, however, an important factor to be considered in taking the long view. A rise in price of a commodity always leads to a search for substitutes. For instance, the rapid rise in tin prices some time ago led to the increased use of aluminium and it is probable that this and other metals will in certain cases replace copper. Such a tendency is very much to the disadvantage of the producers of the displaced metal, for the substitute very often continues to be used long after the price discrepancy has ceased to exist. In the case of copper itself, the rapid rise in 1920 led to substitution which has taken years to overcome. Moreover, inflated prices tend to encourage users to replace worn articles as soon as possible when a cheaper metal can be substituted, and to sell the scrap metal at the high prices prevailing.

On the supply side the Copper Exporters' Association probably appreciates the danger of the present situation and it is improbable that it will make any attempt artificially to limit the supply of copper so as to maintain an uneconomical level. At the same time, however, it would seem that even with normal conditions in Chile and Mexico, production resources will be taxed to their limits to keep pace with the growing demand.

World Output.

The following figures prepared by the American Bureau of Metal Statistics are of interest in this connection as showing world output of copper (in short tons) in 1927 and 1928.

	1928	1927.
United States	1,060,094	968,657
Chile and Peru	363,201	297,093
Europe	135,700	135,100
Belgian Congo	124,172	97,103
Japan	72,796	69,872
Canada	63,040	35,613
Mexico	50,556	43,964
Australia	10,912	10,944
Elsewhere (est.)	36,000	36,000
	1,916,500	1,694,300

It will be seen that Canada has shown a big increase in production and this country is considered to have a great future as a copper producer. Ten years hence, production in Canada will probably reach a figure of 230,000 metric tons per annum according to a Canadian mining official, and from a more optimistic quarter it is foretold that this figure will be reached within five years.

Even more bright is the future of Northern Rhodesia. Very important deposits of ore have recently been dis-

covered there, and it is estimated that within ten years the four principal Rhodesian companies will be producing copper at the rate of 360,000 long tons, or 400,000 short tons per annum.

In view of these and similar developments the ultimate price is expected to average £75 per ton. It will, however, take two or three years before production in these areas reaches a level high enough to affect market prices. In the meantime, prices will be maintained on a higher level unless :—

(*a*) There is an increase in the substitution of other metals for copper.

(*b*) There is a decline in demand as a result of business depression or some similar cause.

The reader will, of course, make his own decision on these two points.

Sensitive Speed Regulator.

Some descriptive notes on a centrifugal electrical governor which will, it is claimed, afford extreme constancy of electric motor speeds.

THERE are numerous purposes, chiefly in telegraphic and radio work, for which an extreme constancy of speed of electrical machines, of the order of 1/10 per cent., or even 1/100 per cent., is required. This constancy has to be maintained in spite of temperature and load variations, and with supply voltage variations of, say, ± 10 per cent. The result must be produced with a minimum of attention, and with simple, robust and inexpensive additions to the existing machinery.

A special centrifugal governor* which meets the requirements was described by Dr. Walter Dornig originally in 1925, and has since been improved. One of these governors is shown in fig. 1, and a simplified diagram of connections for it in fig. 2. It consists of three strong steel springs bent to a large radius as shown, and provided with insulated contacts at the free ends. When the desired speed is reached these moving contacts press against the fixed contacts and so short-circuit a resistance, or, in some other way, influence the speed of the driving motor.

Movable weights are provided underneath the springs to allow for any necessary adjustment, though this adjustment

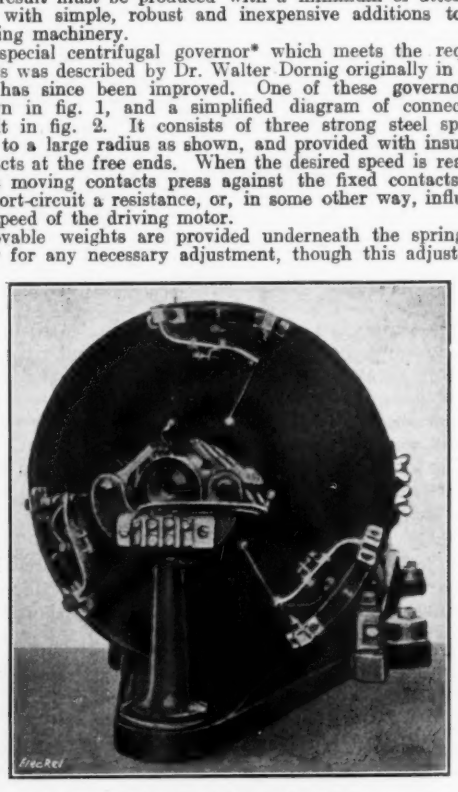


Fig. 1.—Centrifugal Electrical Governor.

can also be obtained by moving the fixed contacts in or out. Bent springs of the form shown give a fine elastic action without the risk of excessive metallic fatigue, which is liable to cause breakage of straight springs at the point of support.

Referring to fig. 2, 1 shows the speed-correcting resistance, *e.g.*, a resistance in the shunt circuit of a d.c. motor; 2 and 2¹ are two slip rings connected to the moving and fixed contacts 4 and 5, on which the brushes 3 and 3¹ rub and make connection to the resistance. The distance between the contacts 4 and 5 is, naturally, very small, and should the motor speed tend to increase, the contacts at once become short-circuited and cut out the resistance in the shunt circuit, and so tend to lower the speed. Actually an extremely fine to and fro motion between the contacts is occurring all the time. It is obvious that the slightest sparking or roughening of the contacts would entirely spoil the regularity of action, and it is in this connection that the third ring 6 is employed. This ring consists of a number of insulated segments like a commutator, the alternate segments being connected to the two rings 3 and 3¹, respectively. The brush 7 rubbing on this commutator is wider than the insulation between the segments, so that it rhythmically short-circuits the two slip rings

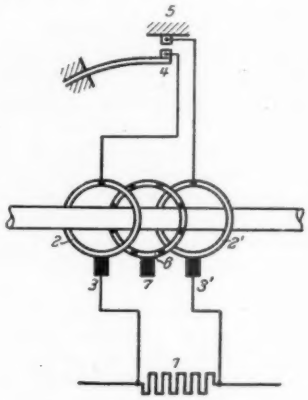


Fig. 2.—Governor Connections.

(and the shunt resistance) at frequent short intervals. Thus, if the speed is 3,000 r.p.m. and there are 16 segments, short-circuiting will occur 800 times per second. Any tendency to sparking at the spring contacts 4 and 5 is, therefore, instantly suppressed by this auxiliary short-circuiting device.

Experience has shown that the arrangement works perfectly satisfactorily for months on end without even any discoloration of the main contacts.

The continuous rhythmical short-circuiting of the resistance by the ring 6 has not the slightest effect on the speed-regulating properties of the apparatus—it merely affects the effective mean value of the motor shunt current.

With a single spring contact on the governor it is found impossible to get really good results with more than 10 per cent. supply voltage variations, as beyond this the resistance required in the shunt becomes comparatively large, and is liable to cause hunting of the motor. For such cases it is preferable to use a number of springs set to make contact at slightly different speeds. In this way the necessary changes in the motor field are so small and are made at such small intervals that no disturbance of the motor occurs. The regularity is further enhanced by the facts that there would be three of the segmental rings 6 in use and that they would be set at 120 deg. to one another, so as to break contact in turn. In practice it is not actually necessary to make up three separate segmental rings—segmental extensions to the slip rings can be interleaved to produce the required result.

With such a governor it has been found quite simple to maintain a speed constancy of 1/10 per cent. with the supply voltage varying from 170 at full load to 250 volts at no load without any sign of sparking or wear at the delicate contacts.

* D.R.P. 457, 499. (*E.T.Z.*)

B.E.S.A. Hydraulic Turbine Tests.

British Standard Specification for Testing of Hydraulic Turbines (No. 353—1929) is the latest addition to the list of B.S. specifications for prime movers, which series includes specifications for steam turbines, reciprocating steam engines, and various types of internal-combustion engines. The latest specification differs from the previous members of the series, however, in the fact that it relates entirely to the testing of the machine, and does not deal with the performance, except in so far as the conduct of the test is concerned. The following points are dealt with in the specification: conditions of head, speed and output for acceptance test; condition of turbine during test; speed variation; power output of turbine; measurement of net or effective head of reaction turbine, Pelton wheel or impulse turbine; errors in measurement; efficiency; and measurement of rate of flow. It is of interest to record that this specification is based on, and is, to all intents and purposes, identical with the International Rules for the Testing of Hydraulic Turbines, published by the International Electrotechnical Commission. Copies of this specification may be obtained from the British Engineering Standards Associaton, Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Date of Mr. Sharp's Return.

In our last issue we incorrectly stated that Mr. E. E. Sharp (Venner Time Switches, Ltd.) had returned from his tour of Australia and New Zealand. As a matter of fact, although Mr. Sharp is on his way back, he will not arrive until the first week in May.

We have received from Mr. Sharp a copy of the "Municipal Monthly Review," published by the Christchurch City Council, New Zealand. It is worthy of note that at least half the contents of this bright and well illustrated little journal are devoted to matters electrical, a sure indication of the progressive methods of the municipality.

American Electrical Production.

The official figures collected at the biennial census of manufactures taken in 1928 in the United States show that the establishments engaged primarily in the manufacture of electrical machinery, apparatus, and supplies in 1927 had a total output valued at $1,637,407,035, an increase of 6.3 per cent. as compared with $1,540,002,041 reported for the last preceding census year (1925). Of the total value for 1927, $1,551,816,138 represented electrical machinery, apparatus and supplies, and $85,490,897 miscellaneous products and receipts for contract work and repairing. The value for electrical machinery, &c., was made up as follows:—Batteries, $150,216,485; control apparatus, $33,869,615; electric fans, $10,755,001; generators, motor-generator sets, and automobile starter motors, $115,179,671; household heating and cooking appliances, $72,933,274; industrial apparatus and appliances, not including motor-driven tools and devices, $12,343,673; interior conduits and fittings, $42,105,294; incandescent lamps (bulbs only), $87,933,204; measuring instruments, relays, and instrument transformers, $34,009,999; motors (not including automobile starter-motors), motor parts, and supplies, $122,146,337; radio apparatus and radio tubes, $191,228,647; switchboards, circuit breakers, and switches, $70,801,619; telephone and telegraph apparatus, not including radio, $119,271,904; transformers, induction voltage regulators, and current-limiting reactors, $66,611,334; wiring devices, $32,216,698; and miscellaneous electrical machinery, apparatus, and supplies, $390,193,383.

The statistics for 1927 and 1925 are presented in the following table:—

	1925.	1927.	Percentage increase or decrease.
Number of establishments	1,739	1,777	+ 2.2
Wage-earners (average number)	239,921	246,565	+ 2.8
Wages	$323,834,541	$336,238,750	+ 3.8
Cost of materials, factory supplies, containers for products, fuel, and purchased power, total	$636,692,076	$645,761,699	+ 1.4
Materials, supplies and containers	Not reported separately	$626,617,053	—
Fuel and power		$19,144,646	—
Products, total value	$1,540,002,041	$1,637,307,035	+ 6.3
Electrical machinery, apparatus and supplies	$1,435,470,008	$1,551,816,138	+ 8.1
Other products, value, and receipts for contract work and repairing	$104,532,033	$85,490,897	−18.2
Value added by manufacture	$903,309,965	$991,545,336	+ 9.8
Horse-power employed	589,398	668,701	+13.5

American G.E.C. to Institute a Five-day Week.

The New York correspondent of *The Times* reports that the General Electric Co. has announced its intention to put all its plants on a five-day week schedule in July and August. Many thousands of workmen will be affected by the new order.

Recent Contracts.

W. T. Henley's Telegraph Works Co., Ltd., has recently been very active in India. The company's Indian contract staff has, of course, been busy on the electrification of the G.I.P. Railway, and a considerable order has been received from the Ajmera Electric Supply Co., Ltd., for the supply, laying and jointing of paper-insulated cables and the installation of distribution pillars, joint boxes, &c., and a smaller contract from the same concern for the supply and jointing of h.p. junction and terminal boxes. The company is also engaged in a number of smaller contracts for jute mills. Another interesting contract being carried out by Henley's is that at Jhansi (United Provinces) for the supply and installation of h.p. underground feeder cables, l.p. overhead feeders and distributors, street lighting fittings and equipment for three sub-stations, the system being 2,200/460 V, 3-phase, 50 cycles.

The D.P. Battery Co., Ltd., has received orders through the English Electric Co., Ltd., for seven batteries in connection with the South-East England Electricity Scheme. The very large battery supplied by the company for the Brisbane (Queensland) automatic telephone exchange was recently put into commission.

The *Financial Times* reports that the Swedish Telegraph Board has given Marconi's Wireless Telegraph Co., Ltd., an order for equipment for a new 60-kW broadcasting station, near Stockholm. The cost of the equipment will be about kr.400,000, and delivery is to be made next November.

The Manchester Corporation has purchased nine "Cyclone" 'bus and car-washing plants (4 gun size) from the Equipment and Engineering Co., Ltd.

Ambitious N.E.L.A. Convention Programme.

A motion talking picture bringing into the Convention Hall speakers of national and international fame; another motion talking picture giving a lecture entitled "The Romance of Power"; spectacular displays and uses of electrical wonders among the exhibits; a great "Festival of Light" contributed by Atlantic City; the dedication of a new $15,000,000 auditorium; personal addresses by well-known electrical men; and famous operatic stars are among the special features which will mark the fifty-second convention of the National Electric Light Association, in Atlantic City during the first week in June.

Competition of Industrial Designs.

The public exhibition of works sent in for this year's open Competition of Industrial Designs will be held in the Exhibition Pavilion of the Imperial Institute, South Kensington, S.W. Full particulars of the scholarships and prizes offered in connection with the competition can be obtained from the Secretary of the Royal Society of Arts, Adelphi, W.C.2. Applications for forms of entry, labels, and instructions must be sent to the Secretary between May 1st and 11th, and the last day for receiving entries is May 27th. The judging takes place in July, and the accepted designs will be exhibited to the public at the Imperial Institute from August 3rd to September 1st.

Copper Consumption in the United States.

According to the National Electric Light Association the electrical industry of the United States consumes over 100,000 tons of copper per year, which is half of the country's total consumption. The proportions of the latter used by branches of the industry are: Electrical manufacturers, 23 per cent.; light and power lines, 14 per cent.; telephone and telegraph, 11 per cent.; sundry allied lines, 2 per cent. The next largest consumer is the automobile industry, with 13 per cent. of the total. An increase of 10 cents per lb. in the cost of electrolytic copper before fabrication means a rise of something over 12 cents per lb. in the price of finished wire. This represents an added expense in the construction of new facilities of at least $25,000,000 per year. Applied to farm electrification, it means an added cost of $40 to $67 for electrifying each new farm. Applied to the telephone and telegraph industry, the increase in the cost of copper means about $20,000,000 added to the construction budgets of the year; and to the electrical manufacturers it means nearly $50,000,000.

Book Notices.

"Can We Trade with Russia?" By Edouard Luboff (48 pp.). London: The Anglo-Russian Press. Price 1s.—After making what appears to be an unbiased review of the situation of Russia, with special reference to its foreign trade, the author of this booklet answers his own question in a qualified affirmative. He scouts the idea that the resumption of full trade relations with Russia would solve our unemployment problem, and aims at showing that if export credits are to be granted there are far safer directions in which they can be usefully employed. Dr. Luboff thinks that there is no immediate possibility of Russia becoming a valuable and progressive market for British goods, but he also considers that the present balance of Anglo-Russian trade is too much in Russia's favour and should be righted. In discussing methods of doing business with Russia, the author mentions banking control, deposits on imports, and clearing-house operations. The last of these is considered most practicable.

Circulars of the U.S.A. Bureau of Standards, No. 374; "X-Ray and Radium Protection—Recommendations of International Congress of Radiology" (price 5 cents).

"Science Abstracts (A and B)." Vol. XXXII. March 25th, 1929. Part 3. London: E. & F. N. Spon, Ltd. Price 3s. each.

"*Journal* of the Institution of Engineers in Australia," incorporating transactions, discussions, &c. Vol. I, No. 2; February, 1929. Sydney, N.S.W.: The Institution, 16, College Street.

Bankruptcy Proceedings.

L. J. Smith, electrical, radio and cycle engineer, late of 3, Lower Kings Road, Berkhampstead.—Receiving order made April 2nd on debtor's own petition.

H. A. Hyde, wireless dealer, late of 2, East Street, Bromley, Kent.—Last day for proofs for dividend, April 20th. Trustee and Official Receiver, Mr. T. Gourlay, 29, Russell Square, W.C.1.

E. Temple and Mrs. J. E. Burkett (Westoe Electrical Co.), 105, Canterbury Street, South Shields.—Last day for proofs for dividend, April 22nd. Trustee, Mr. A. J. Gray, 48, Pilgrim Street, Newcastle-on-Tyne.

O. C. Lay (Home Wireless Installation Co.), accumulator specialist, 2c & 2d, High Street, Wandsworth, S.W.—Last day for proofs for dividend, April 20th. Trustee and Official Receiver, Mr. T. Gourlay, 29, Russell Square, W.C.1.

Company Liquidations.

Ashworth & Smith (Electrical Supplies), Ltd.—Winding up voluntarily. Liquidator, Mr. B. H. B. Eldridge, 52, Brown Street, Manchester. Meeting of creditors, April 16th, at the Manchester Chartered Accountants' Society, 60, Spring Gardens, Manchester. Particulars of claims to be sent to the liquidator forthwith.

New Standard Wireless Valve Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. H. Janes, 27, New Hall Street, Macclesfield. Meeting of creditors at the register offices of the company, High Street, Bollington, near Macclesfield, on April 12th. Particulars of claims to the liquidator by May 12th.

Dissolution of Partnership.

W. G. Pye & Co., manufacturers and sellers of wireless, transmitting and receiving sets and apparatus, scientific instruments and apparatus, physical and electrical apparatus and instruments, &c., Granta Works, Cambridge.—Mr. W. G. Pye, T. A. W. Robinson and H. J. Pye have dissolved partnership. Messrs. W. G. and H. J. Pye will attend to debts and continue the business of manufacturers and sellers of scientific instruments and apparatus, physical and electrical apparatus and instruments, &c., under the old style.

Reduction of Capital.

North Wales Power Co., Ltd. and Reduced.—A petition has been presented to the High Court for the confirmation of the reduction of the capital of the company from £1,000,000 to £808,058, and will be heard in London on April 15th.

A North-Midland E.D.A. Conference.

A sales conference was held by the North-Midland Area E.D.A. on the evening of April 4th at the Corporation Electricity Offices, Leeds. The speaker was Mr. D. Millner, of the Westminster Electric Supply Corporation, Ltd., who read his paper on "Organising for Better Selling in Electrical Showrooms," which was abstracted in our issue of October 26th last (p 709). Mr. F. N. Rendell Baker, borough electrical engineer, Halifax, supported by Col. W. A. Vignoles, D.S.O., presided. There was a good attendance, and a very lively discussion was provoked.

Foreign Samples Exhibitions.

During last year a series of exhibitions of samples of foreign competitive goods was held by the Department of Overseas Trade in conjunction with the Chamber of Commerce of Birmingham. The Council of the Chamber, in its annual report, states that it is of the opinion that these exhibitions are of great value to manufecturers—a view which is confirmed by the large number of interested firms which have sent competent representatives to inspect the samples, and the number which have borrowed samples for closer examination, and also the foreign catalogues which are available.

B.T.-H. Magnetos in Long-distance Record.

In a recent test at the Montlhéry track, Paris, a motor-cycle was driven night and day for between 23 and 24 days, covering a distance of 25,000 miles. The machine was fitted with a B.T.-H. magneto, which during the run made over 50 million sparks.

The Italian Lamp Market.

During the fiscal year 1922-1923 the production of electric lamps in Italy totalled 5,000,000; in 1927-1928 the production amounted to 13,379,143, an increase of about 170 per cent. Electric lamps are manufactured in Italy by about twenty firms, of which the most important are the Società Edison Clerici, Milan, the Società Industria, Italiana Elettrichi Radio, and the Società di Montel. The home production is, however, insufficient to cover the needs of the market. The imports of electric lamps and the countries from which they came during the past two years were as follows:—

	Number of Lamps Imported. 1927.	1928. Jan.-Sept.
Holland	7,865,386	6,859,821
Germany	5,762,212	4,393,889
Austria	1,748,540	1,111,251
Switzerland	137,022	346,917
Hungary	1,037,600	470,957
Great Britain	—	197,998
Other countries	122,763	127,404
Total	16,673,523	13,508,237

These figures show that there is a very considerable opening for foreign lamps of suitable makes and prices. The best-known foreign brands on the Italian market are "Philips," "Osram," "Pop," "Tungsten," and "Vertex." The screw cap is almost universally used. The import duties are: lamps weighing up to 70 grammes, 480 gold lire per quintal; above that weight, 720 gold lire per quintal. There is also an additional tax of 90 centesimi on each lamp.

Estonian Foreign Electrical Trade.

According to the *Board of Trade Journal*, the imports of "electric machines, apparatus, and implements" into Estonia during January had a value of 173,318 E.kr. (about £9,600). Exports of this class were valued at 40,330 E.kr. (about £2,200).

American Vacuum Cleaner Exports.

From a recent article in *Commerce Reports*, it is learned that Great Britain was the largest customer for American electric vacuum cleaners in 1928; 29,018 machines, valued at $542,744 were supplied. The next in importance, Australia, was a long way behind, having taken 8,251 cleaners, valued at $192,979. Another British Dominion, Canada, took the third largest share, 7,368, valued at $197,828. The total value of exports of this class from the United States was $1,307,957 (60,269 machines). The same article deals with the competition which United States manufacturers have to meet, and it is said that Sweden is the principal competitor; the value of Swedish cleaners taken by the United Kingdom in 1926 was $236,155.

The Trade Delegation to Russia.

Reuter (Moscow) reports that Mr. H. Drummond-Wolff, a member of the British Trade Delegation to Soviet Russia, in the course of a statement issued to the Russian Press on behalf of his fellow delegates, said that before leaving England they secured the sympathy of some of the great British banks, but it was not their object to connect their efforts and interests with large international financial organisations. The enormous potential resources of Russia when brought into proper co-operation with British industrial and financial forces could not but give results of great magnitude. The firms represented in the delegation would not be dealing simultaneously, selling money and goods, as appeared to be the custom in the case of many firms working with Russian commercial organisations abroad. They hoped, on the other hand, by co-operating with Russia to create a wider economic basis for trade. They understood full well that Anglo-Soviet trade could only be conducted on a large and adequate scale if an economic basis was found which would open Russia's gates to the British money market. Their visit already promised to bear fruit. In an interview with the Press, Mr. Ernest Remnant is reported to have said that the Delegation would base its relations with economic organisations in Soviet Russia upon the principle of mutual benefit. The economic organisation of the two countries was a guarantee that the business relations between them could develop extensively. The great advantage enjoyed by the U.S.S.R. was its foreign trade monopoly, which made it possible for it to place a large number of big orders with foreign industries. British industry would be able to adjust itself to the demands of the Soviet market. The receipt of big orders would make it possible for British factories to produce machinery especially required by the U.S.S.R.

German Electrical Prices Increased.

The price bureau of the Central Union of the Electrotechnical Industry announces an immediate increase of from 5 to 10 per cent. in sale prices. In explanation it is mentioned that since the last revision of prices the costs of materials, especially copper and its alloys, have risen by from 60 to 70 per cent.

"Thor" Domestic Appliances.

The EDISON SWAN ELECTRIC CO., LTD., announces that, as from April 1st, it has taken over the business of the Hurley Machine Co., and is now responsible for the distribution, sale and service of all "Thor" products in Great Britain and Ireland. The business will continue to be operated from Oxford Circus House, 245, Oxford Street, W.1, and the "Thor" selling, service, and clerical staffs have been taken over by the Edison Swan Co. The principal products involved are washing machines, ironers, and vacuum cleaners.

In a recent "Thor" national window display competition the Newcastle-upon-Tyne Electric Supply Co., Ltd., secured the first prize with the window depicted in the accompanying illustration. A cylinder washer was shown in continuous operation. The spindle of the agitator washer seen in the centre of the window was packed with bandage and the agitator was pressed firmly on the spindle, thus allowing the agitator to revolve backwards and forward all day. The machines were controlled by a time switch cutting off at 11 p.m. Washing and ironing demonstrations were given for two hours in the morning and two hours in the afternoon daily. The second and third prizes were awarded to the North Metropolitan E.P.S. Co. for displays at its Palmer's Green and Wembley showrooms.

A "Thor" Demonstration Window arranged by the Newcastle-upon-Tyne Electric Supply Co., Ltd.

New Catalogues and Lists.

MESSRS. NEGRETTI & ZAMBRA, 38, Holborn Viaduct, E.C.1.—A comprehensive catalogue (List E.5) of engineering and industrial instruments (460 pp.). This contains illustrated particulars and prices of barometers, thermometers, pressure gauges and hydrometers, and other instruments of many patterns. The catalogue is divided into 21 main sections, and a thumb index is provided. A number of tables are included, notably a Fahrenheit-Centigrade conversion table. The list exhibits a serious attempt to standardise many instruments as regards size, range, threads, &c.

THE A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, Westminster, S.W.1.—An illustrated folder dealing with "A.E.G." water heaters, massage and h.f. apparatus, &c., and another dealing similarly with all kinds of domestic appliances.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Book 5, Section 2c, illustrating and describing the "Pul-synetic" system of electric turret clocks.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Leaflet No. 402, illustrating a number of examples of "Phililite" diffusing units, with details showing the ease of erection. Also Leaflet No. 203, giving particulars and prices of the company's industrial lighting fittings.

MESSRS. R. W. CRABTREE & SONS, LTD., Water Lane, Leeds.—A pamphlet giving some particulars of "Victory" d.c. motors and dynamos which are claimed to have a very good output/weight ratio.

MESSRS. HEYES & CO., LTD., Wigan.—A pamphlet advertising the company's switchgear in a novel manner.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue No. P.246, containing illustrations and particulars of wood and steel poles, ironwork, insulators, terminal boxes, and other transmission line materials; a list of the company's many manufactures, including particulars of its overseas branches and agents; and a bell wire price list.

Calendar-blotters for March have been received from Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile-End, Glasgow; Messrs. S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, W.1; and Messrs. WARREN BROS. (MIDDLESBROUGH), LTD.

MESSRS. DAVEY, PAXMAN & CO., LTD., Colchester.—Publication No. 952, describing in a very complete manner the "Paxman" oil engine, with illustrations of actual installations in public and private electric power stations. Fully illustrated.

DRAKE & GORHAM WHOLESALE, LTD., 67, Long Acre, W.C.2.—Pamphlet No. 463, containing illustrated particulars and prices of various types of vacuum cleaners—"Busy Bee," "Goblin," "Vac-Tric," "Universal," "Tellus," "Electrolux," and "Croydon," and of "Hobby" and "Dandy" floor polishers.

The HENDON ELECTRIC LAMP CO., LTD., 104, Southampton Row, W.C.1.—A series of priced and illustrated leaflets advertising the company's electric food warmers, plugs and sockets, two-way adaptor, and electric irons.

MESSRS. HENRY WALLWORK & CO. (1920), LTD., Red Bank, Manchester.—Leaflet 69, giving particulars of enclosed double-reduction helical gears.

THE DRAYTON REGULATOR & INSTRUMENT CO., LTD., West Drayton, Middlesex.—An illustrated pamphlet describing in some detail the company's pressure- and temperature-operated switches. Also leaflets illustrating and describing "Drayton" thermo-contactors and differential humidity regulators.

OMEGA LAMPWORKS, LTD., Rodney Place, Wimbledon, S.W.19.—A priced leaflet advertising the company's flame lamp.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Leeds.—A stock list of single-, two- and three-phase motors of various sizes ranging from 0.5 to 40 h.p.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester—A pamphlet treating of the subject of power-factor correction, with special reference to the company's synchronous motor control gear.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Leaflet No. 170, containing illustrations and full particulars (including dimensions and weights) of the company's pole-type transformers.

The G.E.C. Sports.

The General Electric Co., Ltd., announces that its tenth annual London sports meeting will be held at Wembley on June 8th.

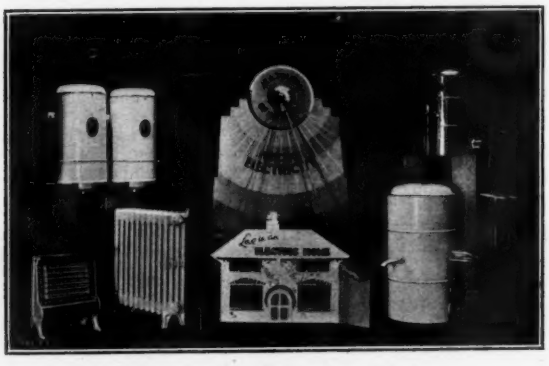
Representation on West Midlands J.E.A.

The Minister of Labour announces that he is to designate to the Electricity Commissioners the employés' organisations having members in the employment of authorised undertakers in the West Midlands Electricity District in order that the

organisations so designated may choose a representative for appointment to the Joint Electricity Authority. Employés' organisations desiring to be considered in this connection are directed to make application to the Minister not later than April 22nd, on a special form obtainable from the Secretary, Ministry of Labour, Montagu House, Whitehall, S.W.1.

E.D.A. Activities.

The Supplementary Programme for April issued to members by the British Electrical Development Association directs attention to the subjects of electric fires and electric water heating, both of which are appropriate to the season. Electric fires are the most convenient form of heating during the cold snaps which are only too frequent in the spring, while during this season the domestic boiler goes out of use and an electric geyser provides a more efficient substitute.



An E.D.A. Water-heating Display.

The aids available to suppliers of electrical energy and apparatus as usual take the form of a series of special national advertisements, "lay-outs" for use in local newspapers, attractive pamphlets, lectures, and two special window displays. These displays deal respectively with electric fires and electric water heating; the latter is illustrated in the accompanying figure.

The Sydney Bribery Charges.

It was announced last week that the State Attorney-General had decided to appeal against the recent decision of the Court allowing the appeal of Messrs. Babcock & Wilcox, Ltd., from a judgment fining them £1,000 and ordering them to repay £10,600 for their alleged complicity in bribery in connection with a Sydney power plant contract.

Trade Announcements.

The address of the Diamond Fibre Co., Ltd., is now 79, Knightrider Street, Queen Victoria Street, E.C.4.

K.N. Electrical Products, Ltd., has moved to new factory premises at 5-7, Singer Street, Tabernacle Street, E.C.2.

The Nox Electric Lamp Co., Ltd., Clarence Road Works, Hunslet, Leeds, states that owing to the demand for its lamps deliveries have been delayed. The works are being extended, and it is hoped that with improvements which have been instituted orders will be more promptly dispatched.

Mr. Cecil Hodges states that he has no connection with any company bearing his name except the Hodges Switchgear Co., Ltd., and Hodges & Dixon, Ltd. The Hodges Switchgear Co. has a large works at Drayton Park, N.5.

London Electricians' Strike Ended.

Meetings were held on April 5th between representatives of the National Federated Electrical Association and the Electrical Trades Union and between the E.T.U. and the Engineering and Allied Employers' Federation in connection with the strike of London electricians. As a result the E.T.U. instructed its members to resume work, and it was decided that a meeting should be held at the end of April, at which the E.T.U. and the Engineering and Allied Employers' Federation would discuss the question of an increase in the wages of men engaged in electrical installation work on lifts. The strike, which lasted a fortnight, was due to an effort by the London District Committee of the E.T.U. to eliminate non-union labour from electrical lift installation work and to enforce the payment of electricians' rates for the work.

For Sale.

Aldershot Borough Council Electricity Department has for disposal one battery, 300 amp., with wooden stand and insulators. Sheffield Corporation Water Works Committee invite offers for surplus power plant, &c. (See our advertisement pages to-day.)

Electrical Propaganda in Norway.

The Norwegian Electrical Plants Federation has recently decided to initiate a large-scale advertising campaign in favour of a more extensive use of electricity in the home. The Federation will function as an information bureau, and supply local municipal authorities and private concerns with information on electricity and its varied uses.

Zagreb Trade Fairs.

Electrical goods are to be exhibited in the Zagreb Trade Fair, Jugo-Slavia, from September 7th to 16th, when a full range of manufactures of all countries will be shown. The Spring Fair, which is being held from April 20th to 28th, is confined to motor cars and cycles, agricultural machinery, and gramophones. It is stated that 300,000 people visit the Zagreb Fairs each year.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Eyre, R. E., & Sons, South Yardley, Birmingham.
Ashworth, W., Horwich.
Harris, F. W., & Co., Coventry.
Moffett, C. R., South Shields.
Whitton, Fred, & Son, Kirkstall, Leeds.
Rock Electrical Engineering Co., Oldham.
Carrack, J. W., & Son, Kirkstall, Leeds.
Henwood, J. H., & Co., Aldgate, E.1.
Rugby Electrical Engineering Co., Rugby.
Hall's Longitudinal Lighting Co., Ltd., Victoria Street, S.W.1.
Lincoln & Egerton, Great Yarmouth.
Davis, H., & Son, Walsall.
McRobb, A., Aberdeen.
Dove, W. E., & Co., Ltd., Darlington.
Barnes, F. A., & Son, Shoreham.
Durrant, L. H., Harborne, Birmingham.
Bessant, A. J., Ltd., Eastbourne.
Lye, C., Exeter.

The annual meeting of the Register is to be held on Monday next, April 15th.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, April 9th: Copper (electrolytic) bars, £107, £4 dec.; ditto ditto sheets, no change; ditto ditto wire rods, £117, £4 dec.; ditto ditto h.c. wire, 1s. 2½d., 7/16d. dec.

Messrs. James & Shakespeare report, April 9th: No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £26, 35s. dec.

Messrs. Edward Till & Co. report, April 9th: India-rubber, Para fine, 1s. 0½d., ½d. dec.

In their letter dated April 6th, Messrs. James Forster & Co. stated that on March 25th the lead market suddenly collapsed, prices falling rapidly until £26 15s. was touched for June. A further fall was seen in the next two days, but on the Thursday before the holiday the tone was a little firmer again. On the resumption of trading after the holidays a firm tone was still in evidence, but on Thursday last week a fresh break occurred, prices falling to £24 10s. for all positions. The American price was marked down in sympathy. Prices have now returned to a level only slightly higher than that ruling before the extraordinary advance started. Little buying has been done during the last fortnight by consumers, but when the market finally settles down and confidence returns, there should be considerable buying. Present arrivals are sufficient for current needs.

Lighting and Power Notes.

Barking.—Supply to Housing Estate.—The Urban District Council Electricity Committee has received a letter from the chief engineer of the L.C.C. asking if the Council would supply electricity to the houses proposed to be erected on the Becontree Estate within the Barking district, if the County Council wired such houses. The Committee has recommended the Council to agree to afford the necessary supply, and asked the engineer to report as to the necessary mains, &c., extensions, including the question of the street lighting of the portion of the estate in question.

Barnstaple.—Special Order.—The Rural District Council has decided to consent to the application of the Ilfracombe Electric Light and Power Co., Ltd., for a Special Order enabling it to supply in Mortehoe, Berrynarbor, and Combe-martin. The proposed maximum charge for electricity is 1s. per kWh.

Beckenham.—Loans.—The Urban District Council has applied for sanction to the following loans: Mains and services, £25,000; sub-stations, £5,000; sub-station switchgear, £2,000; e.h.p. cable, £1,837.

ELECTRICITY IN BULK.—An agreement has been reached with the West Kent Electric Co., Ltd., for a partial supply of electricity in bulk.

NEW SHOWROOMS.—It is proposed to erect new electricity offices and showrooms.

Birmingham.—HAMS HALL STATION.—The Corporation Electricity Supply Committee, accompanied by the Lord Mayor, recently officially inspected the Hams Hall power station, near Coleshill. It is anticipated that supplies will be available from this source for next winter's load. It is probable that the official opening of the station will take place in October, but no definite arrangements have yet been made.

ELECTRICITY SUPPLY PROGRESS.—At a recent meeting of the Committee it was reported that 1,130 new consumers were coupled up to the mains during the month of February, representing an aggregate of upwards of 12,000 lamps and 4,500 h.p. in power supplies. The cold weather prevailing during the month was reflected in an increase of 22 per cent. in the quantity of electricity sold as compared with February, 1928. A number of contracts for industrial supplies were approved.

Blackburn.—ADMINISTRATION.—The Town Council, on April 4th, approved the following minutes of two special meetings of the Electricity Committee, which had re-affirmed a previous decision: (1) That no person be supplied with electricity free of charge; (2) that no electrical apparatus be "loaned out" for testing purposes; (3) that all apparatus requiring testing be tested either at the electricity works or the showrooms. That the Committee should have particulars of all electrical apparatus and appliances "on loan" as per stock book on March 31st, 1928. Also that a special committee be appointed to inquire into the organisation and management of the Electricity Department and recommend such measures as they think proper to improve the efficiency of the department.

Bradford.—EXTENSION OF TRANSFORMER CHAMBER.—The transformer chamber at the Corporation's chief gasworks at Birkshall is to be enlarged, at an estimated cost of £2,100, owing to extended use of electricity in the gas plant. The chamber, when completed, will be capable of serving the needs of the whole district, as well as the gasworks requirements.

Chester.—OVERHEAD LINES.—Permission has been received by the Corporation to erect overhead lines between Tarporley and Farndon for the transmission of electricity at pressures of 6,600 V and 440 V.

Chichester.—ELECTRICITY IN BULK.—The Town Council has applied for sanction to a loan of £1,657 in connection with a supply of electricity in bulk to Bognor.

Continental.—FRANCE.—Work is about to be commenced on the construction of a new hydro-electric power station on the River Creuse at Roche-au-Moine (Indre). The plant will comprise three turbo-generators, with a total capacity of 15,000 kW.

AUSTRIA.—The Vorarlberg Illwerke Gesellschaft is establishing a new hydro-electric power station at Vermunt in the Montafon Valley. At first four 30,000-kVA vertical-shaft turbo-generators will be installed, but a fifth set of 50,000 kVA is to be added later. The power generated at the station will be stepped up to 100 kV, and will be transmitted at that pressure to a sub-station 20 miles away, where it will be further transformed to 220 kV for transmission to Southern Germany.

Eastbourne.—PARADE ILLUMINATIONS.—The Corporation Electricity Committee is to erect 27 new lamps with "Paisley" fittings and rings for decorative lamps on the sea wall of the Royal Parade and lay cables at a cost of £1,949.

Epsom.—ELECTRICITY IN BULK.—The Urban District Council Electricity Committee has decided that negotiations shall be opened with the London and Home Counties Joint Electricity Authority for a supply of electricity in bulk.

Formby.—LOAN.—It is anticipated by the Urban District Council that in the next three years it will be necessary to incur capital expenditure totalling £6,500 for development, and application is being made for sanction to borrow this sum.

Henley-on-Thames.—STREET LIGHTING.—The Town Council has decided to adopt electricity for street lighting, and to accept the tender of the Thames Valley Electric Supply Co., Ltd., for public lighting on a five-years' contract.

Irish Free State.—ELECTRICITY SUPPLY BOARD.—On March 28th the Electricity Supply Board assumed control of six additional municipal undertakings, including Dublin, Rathmines, and Pembroke. Previously eight such undertakings had been acquired by the Board, and now only four remain under municipal control. It is expected that electricity supplies from the Shannon will be available at the end of September, and in the meantime the Province of Leinster will be supplied with electricity from the Dublin plant.

Lancaster.—EXTENSION OF SUPPLY AREA.—The Lancaster Town Council has agreed to the proposal of the Electricity Committee to apply for a Special Order to extend the area of supply in parts of the Lancaster and Linnerdale Union. Caton and Halton are two villages anxious for better supplies for domestic purposes, and Hest Bank and Slyne are also applying for electricity. Underground cables are recommended for the Hest Bank scheme, and overhead from Hest Bank to Slyne. The estimated cost is £8,895.

Lytham St. Annes.—LOAN SANCTIONED.—Authority has been obtained by the Corporation to borrow £10,986 for the provision of mains, services and plant, in connection with the extension of the electricity supply to Freckleton, Warton and Brying-with-Kelleaneath.

Maidenhead.—NEW SUB-STATION.—The Town Council has applied for sanction to a loan of £3,800 for the provision of a sub-station in Bridge Road.

Northampton.—SUPPLY TO WATER WORKS.—At a recent meeting of the Corporation Water Committee a report from the water engineer was considered on the question of the electrification of the pumping plant at the Billing Road pumping station, at an estimated cost of £1,750. The approximate saving on the present system is estimated at £300 per annum. The Committee recommended that, subject to satisfactory arrangements being made with the Northampton Electric Light & Power Co., Ltd., as to power supply, the water engineer be authorised to purchase the necessary plant.

Northern Ireland.—ANTRIM.—The Antrim Electricity Supply Company, which intends to develop a hydro-electric power scheme on the Lower Bann, expects to be in a position to supply electricity in a large part of County Antrim and a portion of County Derry by October of this year. A survey is now being made over the route of the first section of the overhead transmission line, which will be 35 miles in length, and will extend from a point near Monkstown to Cullybackey, north of Ballymena. As soon as this line has been erected branch lines will be provided, so that the company will be able to supply electricity to all its main power users. Steps will be taken to ensure that the line and the poles will not mar the scenery of the countryside. At a later stage the transmission line will be extended as far north as Coleraine. The company's hydro-electric plant will be situated at Caronroe.

BELFAST.—At a recent meeting of the City Council it was decided to apply for sanction to a loan of £77,035 for distribution and engineering schemes.

Oundle.—ELECTRICITY SUPPLY.—The Urban District Council has referred the question of a supply of electricity for the town to the Highways Committee for consideration.

Penge.—ELECTRICITY CHARGES.—The Urban District Council has adopted a recommendation by the Works Committee that as the time has arrived when the increase of 33⅓ per cent. in the charges for electricity made in 1920 by the South Metropolitan Electric Light & Power Co. is no longer justifiable, the company be informed that the Council is no longer prepared to pay the increase.

Pontardulais.—SUB-STATION FIRE.—The *South Wales Daily Post* reports that serious damage was done by an outbreak of fire which occurred on March 29th at the distributing station of the Gorseinon Electric Light Co., Ltd. The station and machinery were completely destroyed.

Preston.—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation the chairman of the Electricity Committee said that the Penwortham and Ashton districts required an additional transformer and alterations to mains, the cost of which would be £4,100.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BETHESDA.—Lighting: From 9d. to 7d. per kWh.

WIMBLEDON.—Power: The sliding scale abolished, and the flat rate reduced from 1½d. to 1d. per kWh. Kinemas: Minimum annual consumption of 15,000 kWh, from 3½d. to 3¼d. per kWh; minimum annual consumption of 10,000 kWh, from 3¼d. to 3½d. per kWh.

EASTBOURNE.—Domestic rate under the "all in" tariff: The "unit" charge from ¾d. to ½d. Power, heating and cooking: Flat rate from 1d. to ¾d. per kWh. Lighting: First 2,500 kWh per quarter, 4d. per kWh; next 2,500 kWh, 3½d.; next 2,500 kWh, 3d.; over 7,500 kWh, 2½d. per kWh.

MAIDSTONE.—Telephone system: From 7s. 4d. to 7s. per annum per 30-watt lamp.

OSWESTRY.—*Oswestry Electric Light and Power Co., Ltd.*—Lighting: From 10d. to 8d. per kWh. Power: From 6d. to 3d. per kWh.

Rainford.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently inaugurated by Mrs. Wilson Grundy, wife of the chairman of the local Council. The supply is provided by St. Helens Corporation.

Scotland.—ELECTRICAL DEVELOPMENT.—The Scottish Southern Electric Supply Co., Ltd., has during the past year made further large extensions throughout the Border area. A l.p. distribution system has now been laid down in Innerleithen, and a h.p. line has been provided between the power station in Galashiels and Melrose. The construction of this line has enabled the company to close down the small plant at Melrose and to generate all the electricity required by the consumers in Melrose at Galashiels power station. The Galashiels-Melrose line has been extended to Jedburgh, where the company has contracted to supply new works which are being established there. It has also acquired the existing electricity undertaking in Jedburgh. During the year approximately 17 miles of h.p. lines were added. The question of extending the supply to Stow and to Kelso is receiving attention.

Sheffield.—Mains Extensions.—The Corporation Electricity Committee has authorised mains extensions at a cost of £11,265.

St. Helens.—New Electricity Charges.—The Town Council has decided as from July 1st next to terminate the existing rate of charge for electricity to domestic consumers on the ratable value system. Such consumers will have the option of being charged on either of the following rates: A fixed charge of 5 per cent. per quarter on the ratable value, plus 1d. per kWh; a fixed charge of 5 per cent. per quarter on the ratable value, or £1 per quarter, whichever is the greater, plus ½d. per kWh. If desired, consumers may be charged at a flat rate of 4d. per kWh for lighting and a flat rate of 1d. per kWh for heating, cooking, and domestic power, plus 2s. 6d. per annum meter rent.

Tarleton.—Electricity Scheme.—At a meeting of ratepayers convened by the West Lancashire Rural Council on March 27th, it was decided to adopt an electricity scheme for the district, 161 residents having consented to take a supply. It is proposed to take a bulk supply of electricity and the charges are to be 8d. per kWh for lighting, and 2½d. per kWh for power. There will also be street lighting with 100 lamps.

Turkey.—Submarine Cable.—Les Forges et Ateliers de Constructions Electriques de Jeumont (Nord), France, has recently completed a submarine cable across the Bosphorus. The cable is about 1¼ miles in length, has three 35 sq. mm. conductors, and is intended for the transmission of power at 15,000 V.

Tramway and Railway Notes.

Continental.—France.—The *Morning Post* reports that the Pyrenean electric railway, which is being constructed by the Midi Railway of France, is nearing completion, and it is expected that the first train will run over the new track on July 1st. Hitherto the only route to Barcelona ran east from Toulouse to the Mediterranean coast, along which it travelled south-west to Barcelona. The new route will continue south from Toulouse to Ax-les-Thermes, and will pass through the heart of the Pyrenees to the Spanish border town of Puigcerda. The new cut through the Pyrenees is only 26 miles in length, and will climb from Ax-les-Thermes at an altitude of 2,300 ft. to Puymorens, at an altitude of 5,200 ft. in just under 20 miles.

The Compagnie Paris, Lyons et Méditerranée, one of the principal trunk-line railroads in France, having need of some particularly powerful locomotives for its line from Culoz to Modane, which is now being converted for electrical operation, called for offers from all the important builders in that part of the country. As a result, the company retained four proposals by which the respective builders were to each provide one locomotive to undergo exhaustive trials during a year, when the company would make its choice. Among the four constructors the Société Oerlikon submitted details of a locomotive of 2,400 h.p., with a speed of 130 km. (81 m.p.h.). After two years' service this locomotive was adopted, but the company then requested the builders to prepare a more powerful machine, and the first four are now being built at Ornans, each of 5,400 h.p.; they are of the 4-12-4 type; the driving wheels are in two units of six wheels, all 1.6 m. in diameter, and each pair is driven by two twin motors of 900 h.p. at 1,500 volts d.c., which is supplied by means of an overhead wire, or by a third rail, as circumstances may require. The overall length is 23.8 m., and the gross weight is 158 tons.

Germany.—*The Times* reports that the tramway services of Wiesbaden operated by a private company, have been discontinued on account of the city's refusal to renew the concession. Wiesbaden is now the only one of the larger German cities without a tramway service. Omnibuses have taken the place of the tramcars, and the first day of the experiment proved successful.

Haslingden.—Proposed Abandonment of Tramway.—The abandonment of the tramway in favour of extended omnibus services was suggested at a meeting of the Town Council on April 4th. It was stated that tramway statistics showed an unsatisfactory position. After crediting the surplus from semi-express omnibus service Accrington to Rawtenstall and Bacup, and income from investments, there was a net loss of £225. The estimated loss on tramways for next year, assuming they continued so long with the present competition of semi-express 'bus services, would be £2,330. After crediting an estimated surplus of £821 accruing from running semi-express 'bus services, the deficiency would be reduced to £1,509. The Tramways Committee was unanimously of opinion that the only remedy was to scrap the trams and substitute motor-'buses. It intended to meet Accrington and Rawtenstall representatives early to discuss the position, and it hoped to reach a mutual agreement for the substitution of 'buses.

London.—Tube Lighting System.—The existing lighting installation with 7,000 lamps on the Central London Railway is to be replaced. The cost of the new installation will be nearly £40,000, and sixty-five miles of cable and wire will be used. Hitherto the lighting supply has been by d.c. at 600 V. With the low-voltage a.c. installation, which is to take its place, a better lighting service at lower annual cost will be obtained, maintenance costs will be lower, and the number of lamp failures and renewals will be materially reduced. The new system will also bring the lighting into line with the systems already in use on the other Tube railways, with the usual advantages resulting from standardisation. A further effect of the change will be to provide a supply on the Central London Railway suitable for working certain automatic ticket-issuing machines, small illuminated signs, and automatic "train describers" on the platforms. The work will be started at once and finished next year.

Oxford Circus Station.—The new comb pattern escalator, installed at Oxford Circus station in place of an old-type machine, was put into service on April 5th. This is one of the three escalators connecting the Bakerloo line with the booking hall. It is faster than the old machine by 10 ft. per minute. Four out of the five escalators at this station are now of the comb pattern.

Lytham St. Annes.—Loss on Tramways.—The Corporation Tramways Committee reports a total loss on the tramway undertaking during the past nine years of over £30,000. During the past year the loss was £3,739.

Telegraph and Telephone Notes.

Australia.—Carrier-wave Telephony.—At meetings of electrical engineers held simultaneously in Sydney and Melbourne, communication was maintained by means of the carrier-wave telephone system. Speakers in Melbourne and Sydney were heard with equal clearness at both meetings.

Belgium.—Threatened Wireless Operators' Strike.—Wireless operators, to the number of 160, are claiming an increase of pay, and are threatening to come out on strike should it be refused them. If the strike eventuates, all Pelgian vessels of over 1,500 tons will be affected.—*Reuter* (Antwerp).

Canada.—Radio Beacon.—Canada's first automatic wireless beacon was inaugurated on April 6th on Seal Island, off Nova Scotia. It is the first of a chain of seventeen beacons stretching from the Gulf of St. Lawrence to the Great Lakes.

Telephone Development.—There were 1,259,987 telephones in use throughout Canada in 1927, or 13.2 for every hundred persons living in the country. On the *per capita* basis, Canada is second among the nations of the world in the use of the telephone, the United States being the first with 15.3 per hundred of population, New Zealand third with 9.5, and Denmark fourth with 9.2.—*Reuter's* (Ottawa).

France.—Rural Telephones.—The Post and Telegraph authorities propose to considerably extend the number of automatic telephone exchanges in country villages throughout France during the course of the present year.

India.—Beam Radio-telegraphy.—Our Indian correspondent reports that the first complete year's operation of the beam telegraph service introduced by the Indian Radio Telegraph Co. has resulted in a gross profit of Rs. 10,18,000. After making provision for depreciation and reserve, total dividends of 10 per cent. on ordinary shares and 4 per cent. on deferred shares have been declared. From the date the service was inaugurated, the company handled a much greater volume of traffic than was anticipated. The staff was therefore augmented and put into a much better position for dealing with the requirements of the service in all its branches. A significant feature of the increased traffic is the large proportion of "full rate" messages, almost all of which are sent in code. This particular feature is the best evidence that the accuracy and speed of the service are meeting the requirements of the public. There has also been a marked increase during the year in the cheaper classes of traffic, and in this direction the company looks for great expansion of the existing Anglo-Indian circuit. During the past year, in co-operation with the Government of India and the British Post Office, the company extended the facilities for "daily letter telegrams" and "week-end letter telegrams" to many countries.

The company's service still suffers from the handicap of the absence of its own land lines between Bombay, Calcutta, and the other large commercial centres in India. Negotiations are in progress with the Government of India, and if certain proposals which have been made are adopted, this state of affairs may soon be remedied.

The extension of the present wireless service to other countries is engaging the attention of the company's board, and the Government of India has assured the company of its support and has promised sympathetic consideration of any developments of this nature. It is also known that the establishment

of a system of wireless telephony between India and Great Britain, utilising the beam for that purpose, would meet with the approval of the Government of India.

The trading branch of the company's activities has not, however, been satisfactory, but there is hope that the sale of apparatus for other than broadcasting purposes will increase as the value of wireless point-to-point telegraphy or telephony, wireless beacons, public-address systems, &c., becomes more generally recognised. Several schemes for the establishment of wireless communication have been submitted during the year, some of which it is hoped will materialise in the near future.

International Telephony.—Hungary-Rumania.—A new telephone service between Hungary and Rumania was opened on April 2nd; the facility was welcomed, and the new line was extremely busy. By a conversation with the director of the Norwegian Postal Service, Baron Szalay, of Budapest, inaugurated a telephone service with Norway.

Telegraphy.—Code Rules.—The *Financial News* learns that it has been decided by the several representative bodies concerned to give a trial to the telegraph-code regulations which were formulated at the recent Brussels Conference. It will be recalled that a number of objections were at one time raised to the regulations, but the hope is now entertained that the new conditions will give satisfaction, and that no revision may be found necessary in the interval which must elapse before the next Imperial Telegraph Conference, scheduled to be held in Madrid in 1932. The new regulations come into force on October 1st next.

Radio Notes.

Germany.—New Headquarters.—The Funk-Stunde, B rlin, has sold the *Voxhaus* in the Potsdamer Strasse, where the company has had its studios and offices since its foundation in 1923, and has acquired land on which it is intended to construct a new *Funkhaus* for the Berlin stations. It is hoped to begin work on the new building this summer, and to complete it by the end of 1930. The Funk-Stunde has acquired the land, says *World-Radio*, jointly with the Reichs-Rundfunk-Gesellschaft. The new headquarters will contain the offices and studios of the Funk-Stunde and Deutsche Welle, G.m.b.H. (the company controlling the Deutschlandsender at Königswusterhausen), and the offices of the Reichs-Rundfunk-Gesellschaft and Reichs Broadcasting Commissioner. There will be several large studios, and room has also been provided in the plan for a broadcasting museum. The site is quite near the Radio Exhibition Halls at Witzleben.

India.—Broadcasting.—Our correspondent in India informs us that the trading branch of the Indian Radio Telegraph Co.'s activities was not satisfactory during its first complete year's operations. The sale of broadcast receivers and component parts was disappointing, due largely to the slow progress which broadcast telephony has made in India hitherto. Until the Indian public recognises the benefits to be derived from such a service, it will not be possible to increase the sale of this particular class of apparatus very materially.

International Wireless Conference.—"Brussels Plan."—The International Wireless Conference opened at Prague on April 4th. Delegates of 27 European and three non-European telegraph administrations attended, of eight telegraph companies, the International Union of Wireless Telegraphy and the International Committee of Aeronautics. A discussion took place on the Wireless Telephony Committee on the Czecho-Slovak proposals recommending the so-called "Brussels plan" as the basis for the distribution of "radiophonic waves" and co-operation between the World Telegraph Union of Berne and the Wireless Telephone Union of Geneva.—*Reuter* (Prague).

The first conference of the International Consultative Technical Committee of Wireless Communications will take place at The Hague at the end of September, and will probably last ten days.—*Reuter* (The Hague).

New B.B.C. Premises.—Manchester.—The B.B.C. announces that the address of the north regional studios and offices are Broadcasting House, Piccadilly, Manchester. The old accommodation at Orme Buildings has been vacated, and the first programme from the new premises was broadcast on April 8th. The new premises are situated on the north side of Piccadilly, overlooking the municipal gardens. There are three studios: the largest, 54 ft. long by 35 ft. wide, two storeys in height, and containing a gallery for an audience of about 80 people, will be used for big orchestral and operatic performances; the second studio will be used for dramatic performances and other activities, and is 33 ft. long by 16 ft. wide. In addition, there is a small talks studio. A sound effects studio is attached to the dramatic studio, as is also an echo room. The control room is equipped with the latest engineering devices.

Sweden.—New Station.—The Swedish Telegraph Board has given the Marconi Company, of London, an order for equipment for a new 60-kW broadcasting station near Stockholm. The cost of the equipment will be about Kr.400,000, and delivery is to be made next November.—*Reuter's Trade Service* (Stockholm).

United States.—More N.B.C. Stations.—Coincident with an announcement that it is now on a self-supporting basis, the National Broadcasting Company added four southern stations to its coast-to-coast network, which forms the largest group of associated radio stations in the world. The four stations are: WSMB, in New Orleans; WAPI, in Birmingham (Ala.); KTHS, in Hot Springs; and WIOD, in Miami Beach.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 15th. Victorian Railways. One geared 3-phase electric winding engine. (A.X. 7650.)*

May 15th. Melbourne Tramways Board. One 500-kW substation rectifier unit for automatic control, with switchgear. (B.X. 5206.)*

Melbourne Tramways Board. May 15th. Two rotary convertor units of 1,000 kW and one 500 kW for automatic control. (B.X. 5210.)*

Sydney.—May 13th. Public Works Department. One synchronous condenser. (B.X. 5205.)*

May 28th. Posts and Telegraphs Department. Telephone jacks and number plates. (B.X. 5202.)*

Batley.—April 15th. Electricity Department. L.p. cable. (March 29th.)

Bridport.—April 15th. Electricity Department. H. and l.p underground and overhead cables. (March 29th.)

Canterbury.—April 15th. Board of Guardians. Completion of the electric lighting installation at the Guardians' Institution, Nunnery Fields. Specifications from Mr. H. Rose, clerk, 80, Castle Street, Canterbury.

Carlisle.—Electricity Department. L.C. and L.C.A. paper insulated cables for 12 months. (See this issue.)

Dublin.—April 23rd. Dublin Port and Docks Board. Three electric overhead travelling cranes and gantries at new tobacco warehouse, Custom House Docks. Specifications from engineer to the Board, East Wall, Dublin.

Dumfries.—April 17th. Electricity Department. One water cooling tower. (March 29th.)

Dundee.—April 24th. Transport Department. Stores, including armature and field coils, castings, &c., for a year. Specifications, &c., from general manager.

April 27th. Harbour Trustees. Two 3-ton electric travelling jib cranes of portal type. Specifications, &c., from office of the General Manager and Engineer, Harbour Trust.

Edinburgh.—April 15th. East Lothian Education Authority. Electrical and heating installations for the new school at Tranent. Schedules, &c., from R. & A. K. Smith, surveyors, 4, Forres Street, Edinburgh.

April 22nd. Education Authority. Electric lighting and heating installation at the new school at Saughton. Plans, &c., from Mr. J. A. Carfrae, architect, 3, Queen Street, Edinburgh.

Edlington.—April 17th. West Riding Education Committee. Installation of electric lighting at new schools and caretaker's house. Education Officer, County Hall, Wakefield.

Egypt.—Cairo.—May 15th. Ministry of Public Works. 120-kW d.c. Diesel-engine generating set and a small electrically-driven cooling water pump. Forms of tender from the Chief Inspecting Engineer, 41, Tothill Street, S.W.

Epping.—May 2nd. Board of Guardians. Installation of electric light at the Institution, Epping. (See this issue.)

Irish Free State.—Dublin.—April 29th. Electricity Supply Board. Supply and laying of 40,000-V cables in the County and City of Dublin. (April 5th.)

Irvine (Ayrshire).—April 15th. Town Council. Electric lighting installation at housing scheme. Specifications (deposit of £1 1s.) from Town Clerk.

Leeds.—April 17th. Board of Guardians. New steam-driven generating sets, boiler feed pumps, &c., new switchboards and mains, &c., for the Rothwell Institution. Specifications from Mr. E. Griffiths, consulting engineer, The Temple, Dale Street, Liverpool.

London.—Central Electricity Board.—April 15th. North-West England and North Wales Electricity Scheme, 1928. 33,000-V overhead transmission lines. (March 1st.)

May 4th. Supply, delivery and erection of 33,000-V and lower-voltage cables in connection with the South-East England Electricity Scheme. (See this issue.)

April 29th. Central Scotland Electricity Scheme, 1927. Electricity meters. (March 15th.)

Islington.—May 6th. Cleansing Committee. Two new lead batteries for Edison electric vehicles. (April 5th.)

London County Council.—April 22nd. Reconstruction of conduit tramways in Whitechapel High Street. Specification (£5) from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

H.M. Office of Works.—April 22nd. Supply of incandescent electric lamps. (See this issue.)

Lourenço Marques.—April 22nd. Port and Railways Board. Electric hanging and ordinary lamps. (B.X. 5188.)*

Manchester.—April 16th. Tramway Committee. Electric welding equipment for tram rails. General manager, 55, Piccadilly, Manchester.

April 24th. Electricity Committee. Stores for 12 months, including dry batteries, conduit and wiring accessories, fuse boxes, auto-transformers, &c. Particulars from Mr. H. C. Lamb, Chief Engineer and Manager, Electricity Department, Town Hall.

Smethwick.—April 17th. Electric lighting installation at Slipper Baths, Mallon Street. Specification (£1 1s.). Form of tender from Mr. R. Fletcher, borough engineer, Council House.

South Africa.—Johannesburg.—May 16th. South African Railways and Harbours. Electric signalling apparatus. (B.X. 5165.)*

Cape Town.—May 1st. Electricity Department. 30-ft. steel tubular poles, cross arms, insulators, &c. (A.X. 7697.)*

Bloemfontein.—May 18th. Electric Supply Department. Turbine and generator, condensing plant and auxiliaries; switchgear and cables; cooling spray pond equipment, or alternatively cooling tower complete. (B.X. 5192.)*

Southampton.—April 30th. Electricity Department. Steel-framed building, steelwork for firing floor, platform carrying induced draught fans, overhead bunkers, &c.; two water-tube boilers with superheaters, economisers, air heaters, mountings, chain-grate stokers, water walls, induced and forced draught fans, sootblowers, steel flues and chimneys, grit arrestors and collectors, &c.; steam, feed-water and other piping, covering, &c.; water softener. (March 29th.)

Stafford.—April 30th. County Education Committee. Installation of electric lighting and power at the New High School for Girls, Wellington Road, Bilston. Installation of electric light at the Girls' High School, Stafford. (See this issue.)

Uruguay. — Montevideo.—May 6th. State Electricity Works. Electric cables and accessories. (B.X. 5178.)*

Walthamstow.—May 3rd. Education Committee. Electrical installation for the Billet Road school. (See this issue.)

Wolverhampton.—May 10th. West Midlands Joint Electricity Authority. One 50,000-kW turbo-alternator with step-up transformers, &c., condensing plant, boiler feed pumps, evaporators, circulating water pumps, &c., main and auxiliary 33,000-V switchgear with circuit breaker. (March 29th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Melbourne.—Commonwealth Department of Works and Railways.

Six motor control switches, three distribution and cut-out boxes, and 2,700 bin magnets for mail handling plant, Sydney (£2,011).—Standard Telephones & Cables (Australia), Ltd.

Victorian Railways.

Copper conductor (£2,422).—British Insulated Cables, Ltd.

State Electricity Commission of Victoria.

22,000-V oil circuit breakers (£4,427).—Siemens (Australia) Pty., Ltd.

22,000-V 3-core cable (£8,222).—British Insulated Cables, Ltd.

Water-tube boilers with auxiliary and accessory equipment (£223,288).—John Thompson (Australia) Pty., Ltd.

Pilot and telephone cable (£1,665).—Johnson & Phillips, Ltd.

Sydney.—New South Wales Railways.

20 sets headlight turbo-generators (£730).—Coates & Co., Pty., Ltd.

30 sets do. (£930).—Lawrence & Hanson Electrical Co., Ltd.

—*Tenders.*

Beckenham.—Electricity Committee. Accepted:—

E.h.p. switchgear (£188).—New Switchgear Construction Co., Ltd.

L.p. switchgear (£103).—British Insulated Cables, Ltd.

Birkenhead.—Electricity Committee. Accepted:—

One 6,600-V truck type cubicle (£99).—British Thomson-Houston Co., Ltd.

Cable (£137).—W. T. Glover & Co., Ltd.

Three 200-kVA indoor type transformers (£372), one 100-kVA do. (£82).—General Electric Co., Ltd.

Cable.—(£267), Hackbridge Cable Co., Ltd.; (£380), British Insulated Cables, Ltd.

Transformer cubicle equipments (£440).—New Switchgear Construction Co., Ltd.

Oil circuit breaker equipments.—(£154) Allen West & Co., Ltd., and (£32) George Ellison, Ltd.

Cambridge.—Board of Guardians. Accepted:—

Installing automatic telephones (£178). — Siemens-Schuckert (Great Britain), Ltd.

Chester.—Board of Guardians. Accepted:—

Electrical accessories for three months.—F. J. Jones & Sons.

Fylde (Lancs.).—Board of Guardians. Accepted:—

Electrical installation at the Poor Law Institution, Kirkham (£2,239).—P. J. Frampton (Blackpool).

Glasgow.—Corporation. Accepted:—

Installing three new ventilating fans in the fan chamber of the City Hall: Supply and erection of new fans (£149).—Matthews & Yates, Ltd.

Necessary wiring.—Haddon & Co., Ltd.

Tramways Committee. Accepted:—

Rails.—Bolckow, Vaughan & Co., Ltd.

Ilford.—Electricity Committee. Recommended:—

Two switch pillars for Gants Hill sub-station (£605).—Metropolitan-Vickers Electrical Co., Ltd.

Transformer and switch kiosks—

General Electric Co., Ltd.	£694
Yorks. Switchgear and Engineering Co., Ltd.	668
Ferguson, Pailin, Ltd.	617
Long & Crawford	590
Lucy & Co., Ltd.	568
Foster Engineering Co., Ltd.	531
Crompton Parkinson, Ltd. (Recommended)	497

Irish Free State.—Dublin.—Department of Local Government and Public Health.

Six months' supplies of Osram metal-filament, gasfilled and vacuum lamps, also Robertson carbon lamps.—General Electric Co., Ltd.

Electricity and Public Lighting Department. Accepted:—

Change-over time switches (approx. £570).—Roper Bros.

Electric wiring in houses on the Emmet Road (Extension) Housing Area (£4,511).—Hall & Stenson, Ltd.

Twelve months' supply of cables and accessories for the City Electricity Department:—

H.p. and l.p. cables.—Siemens-Schuckert (Ireland), Ltd.; British Insulated Cables, Ltd.; C. J. Vogel; Deutsche Kabelwerke A.G.

Aerial conductors.—British Insulated Cables, Ltd.; Deutsche Kabelwerke A.G.

Section pillars and disconnecting boxes.—British Insulated Cables, Ltd.

Service boxes.—Lucy & Co., Ltd.

Cast iron troughing.—Hammond Lane Foundry Co., Ltd

Stoneware troughing.—Albion Clay Co., Ltd.

Compound.—Berry, Wiggins & Co., Ltd.

—*Irish Builder and Engineer.*

London.—Metropolitan Asylums Board.

Laying service cables for the supply of electricity to Colindale Hospital (£154).—Hendon Electric Supply Co., Ltd. (Accepted.)

Installation of automatic telephone system at the North-Western Hospital:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended.)	£995
L. G. Tate & Co., Ltd.	1,074
Telephone & Electrical Maintenance Co.	1,120
W. J. Furse & Co. (London), Ltd.	1,126
Automatic Telephone Manufacturing Co., Ltd.	1,250
T. Clarke & Co., Ltd.	1,300
Read & Partners, Ltd.	1,360
Ericsson Telephones, Ltd.	1,500

The following tenders were received for the installation of X-ray apparatus at the King George V Sanatorium:—

Schall & Son, Ltd.	£486
Solus Electrical Co.	501
Newton & Wright, Ltd.	571
Alternative	594
Do.	609
Do.	632
Watson & Sons (Electro-Medical), Ltd.	635
X-Rays, Ltd.	677

ADMIRALTY.—
Electric soldering irons.—Electric Heating Co.
Accumulators.—Edison Swan Electric Co., Ltd.
GENERAL POST OFFICE.
Distribution boards.—Edison Swan Electric Co., Ltd.
HAMMERSMITH.—Electricity Committee. Recommended:—
Electrical goods for 12 months.—General Electric Co., Ltd.

Liverpool.—Electric Power and Lighting Committee. Recommended. Supply of materials required during the twelve months ending March 31st, 1930:—
Cables, compounds and tapes for street mains.—Callender's Cable and Construction Co., Ltd.; Penmaenmawr and Trinidad Lake Asphalt Co., Ltd.; Dussek Bitumen Co., Ltd.; British Insulated Cables, Ltd.
Insulated cables.—Mersey Cable Works, Ltd.; William Geipel & Co., Ltd.; Edison Swan Electric Co., Ltd.
Electricity meters.—Ferranti, Ltd.
Incandescent electric lamps.—Tungstalite, Ltd.
Brass and copper castings.—Liverpool Brass and Engineering Co.; R. Roberts & Sons.
A.c. electric motors and starting gear.—Crompton Parkinson, Ltd.; English Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Airedale Electrical and Manufacturing Co., Ltd.
Stoneware, troughing, tiles and concrete cable covers.—Joseph Place & Sons, Ltd.; Doulton & Co., Ltd.; Joseph Parr, Ltd.; S. E. Bonsall; Isherwood Bros., Ltd.

Maidenhead.—Town Council. Accepted:—
Kiosk for the Punt Hill sub-station (£244).—W. Lucy and Co.

Rotherham.—Electricity Committee. Recommended:—
Transformers.—General Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
Switchgear for sub-stations (£5,933).—A. Reyrolle & Co., Ltd.
Thirty 300-kVA and six 450-kVA three-phase transformers (£6,384).—Metropolitan-Vickers Electrical Co., Ltd.
Six 250-kVA single-phase transformers and four 1,000-kVA Scott-connected sets (£2,868).—British Electric Transformer Co., Ltd.
Recommended:—
Boilers and accessories (£140,206).—Stirling Boiler Co., Ltd.
Turbo-alternator and condensing plant (£94,413).—English Electric Co., Ltd.
Pipework and valves (£25,492).—Brightside Foundry and Engineering Co., Ltd.
E.h.p. switchgear (£55,067).—General Electric Co., Ltd.
Transformers (£5,008).—British Electric Transformer Co., Ltd.
Cooling towers and tanks (£19,194).—Davenport Engineering Co., Ltd.
Coal-handling plant (£23,292).—Mitchell Conveyor Co., Ltd.
Cranes (£5,421).—Isles, Ltd.
Battery shunting locomotive (£1,915).—English Electric Co., Ltd.

Spenborough.—
Electrical work at the new Library.—F. W. Birkett & Sons (Cleckheaton).

York.—Watch Committee. Recommended:—
Installation of automatic traffic signals (£523).—Barber and Colman.

Forthcoming Events.

Institution of Engineers-in-Charge.—Friday, April 12th. Holborn Restaurant. 6.30 p.m. Annual dinner.
Tuesday, April 16th. St. Bride Institute, Bride Lane, E.C. 7.30 p.m. "Some Notes on the Engineering Equipment of Institutions Economically Considered." Mr. W. M. Benny.

Royal Society of Arts.—Friday, April 12th. John Street, Adelphi, W.C. 4.30 p.m. "Recent Electrical Developments in India." Mr. A. T. Cooper.

Association of Mining Electrical Engineers (Western Sub-Branch).—Saturday, April 13th. Swansea. Annual dinner.

(South Wales Branch).—Saturday, April 20th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Three-phase Induction Motors and their Control Systems." Mr. H. T. Gregory.

Salford Technical and Engineering Association.—Saturday, April 13th. Royal Technical College. 7 p.m. "Electric Storage Battery Traction." Mr. J. A. Hunt.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, April 15th. Institution, London, W.C. 7 p.m. "Power Supply and Railway Electrical Signalling." Mr. N. G. Tweedie.
ORDINARY MEETING.—Thursday, April 18th. Institution, London, W.C. 6 p.m. "The Modern Use of Pulverised Fuel in Power Stations." Mr. R. A. Chattock.

Institution of Electrical Engineers—*continued.*

(Irish Centre, Dublin).—Thursday, April 18th. Trinity College, Dublin. 7.45 p.m. "Electric Time Signalling." Mr. J. D. Ferguson.

(Mersey and North Wales (Liverpool) Centre).—Monday, April 15th. University, Liverpool. 7 p.m. Annual general meeting. Short papers by members.

(Sheffield Sub-Centre).—Wednesday, April 17th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Practice and Progress in Combustion of Coal as Applied to Steam Generation." Mr. F. H. Rosencrants.

(Tees-side Sub-Centre).—Wednesday, April 17th. Cleveland Technical Institute, Middlesbrough. 7 p.m. Annual general meeting.

(South Midland Centre).—Monday, April 15th. University, Birmingham. 7 p.m. "Direct Generation of Alternating Current at High Voltages." Sir Chas. A. Parsons, F.R.S., and Mr. J. Rosen.

(North-Western Students' Section).—Tuesday, April 16th. Engineers' Club, Manchester. 7.15 p.m. Annual general meeting. "Errors in Current and Voltage Measurements at Radio Frequencies." Mr. F. Roberts.

(London Students' Section).—Friday, April 19th. Institution, London, W.C. 6.15 p.m. Address by Dr. A. H. Railing.

Electrical Association for Women.—Tuesday, April 16th. Hotel Cecil. One-day conference, luncheon, works visit, and ball.

Association of Supervising Electrical Engineers.—Tuesday, April 16th. Junior Institution of Engineers, 39, Victoria Street, S.W. 6.30 p.m. "Variable Speed A.C. Commutator Motors." Mr. C. V. Hill.

Institution of Civil Engineers.—Wednesday, April 17th. Institution, Great George Street, S.W. 6 p.m. "Problems involved in the Design of Overhead Transmission Lines." Mr. E. T. Painton.

British Institute of Radiology (incorporated with the Röntgen Society).—Thursday, April 18th. 32, Welbeck Street, W. 8.30 p.m. Ordinary meeting.

South Wales Transport Co., Ltd.—Thursday, April 18th. Mumbles Pier Pavilion. 1.30 p.m. Luncheon to commemorate the electrification of the Mumbles Railway.

Physical Society.—Friday, April 19th. Imperial College of Science, South Kensington, S.W. 5 p.m. Guthrie lecture. "Properties of the Elements under High Pressures." Prof. P. W. Bridgman.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

SILVERLITE house-lighting plant.

Notes.

X-ray Protection.

We have received Circular No. 374 of the U.S.A. Bureau of Standards dealing with the X-ray and radium protection recommendations promulgated by the International Congress of Radiology at Stockholm last year. These recommendations are substantially the same as those submitted by the British X-ray and Radium Protection Committee, based largely on the experience of the National Physical Laboratory, and it is satisfactory to note their official adoption by the Bureau of Standards. The problems of protection are continually being simplified, and it is intended that the recommendations shall come up for review at the third International Congress of Radiology at Paris in September, 1931. To this end an International Protection Committee was formed at Stockholm, consisting of one representative each from England, France, America, Germany, Sweden, and Italy. Any major questions or suggestions regarding X-ray or radium protection should be referred to this Committee, of which the honorary secretaries are Dr. G. W. C. Kaye (the National Physical Laboratory, Teddington) and Dr. Stanley Melville (9, Chandos Street, London, W.1).

Local Society.

The annual supper and smoking concert of the Paisley Association of Electrical Engineers was held on March 26th. There was a good attendance, presided over by Mr. J. R. Bisland, who was supported by Mr. Barrett (Glasgow) and past presidents W. Flair Smith, W. R. Bruce, R. W. Dodson, James Neil and J. M. Barbour.

Container for Impregnating and Drying.

The Swiss Federal Railways have lately installed an interesting container for impregnating stators, rotors, and transformers, the dimensions of the vessel being 11 ft. 6 in. in diameter by 13 ft. high. It was constructed by Messrs. Sulzer Bros., and the cylindrical part of the container has a longitudinal joint which was welded; the rounded bottom was constructed in two parts, pressed to shape hydraulically, and afterwards welded together, and then welded to the body of the container. Three sets of coils, with a total heating surface of about 590 sq. ft., are arranged in the interior. At the bottom of the container grate-like supports are provided for carrying the parts to be impregnated. In addition, a special carrier can be fitted on which the rotors to be impregnated are hung and kept turning slowly by means of a motor. The container is fitted with safety valves, and has also an inspection hole and thermometers to allow of the process being observed and controlled. The usual working pressure is 56 lb. per sq. in., but the container is also capable of withstanding a vacuum of 100 per cent.

Appointments Vacant.

Wireman for consumers' installation department, and meter reader and fixer for the Radcliffe Urban District Council Electricity Department. Hiring and sales superintendent (£300) for the Borough of Darlington Electricity Department. Draughtsman (66s. 2d.-82s.) and junior technical officer (£266) for the Royal Aircraft Establishment, South Farnborough. Telephone engineer (£738) for the Egyptian State Railways Telegraphs and Telephone Administration. Mains assistant (£200) for the Worksop Urban District Council Electricity Department. Installation inspector (90s.) for the Borough of Stoke Newington Electricity Department. Power sales engineer (£750 to £1,000) for the Irish Free State Electricity Supply Board. Shift engineer for the Borough of Southport Electricity Department. Switchboard attendant for Eastbourne Electricity Department. Shift engineer (£575) for Malaya, for the Perak River Hydro-Electric Power Co., Ltd. Electric cooking demonstrator (£156) for the City of Lincoln Electricity Department. (See our advertisement pages to-day.)

Ionisation in Paper-insulated Cables.

Messrs. C. L. Dawes, H. H. Reichard, and P. H. Humphries presented a paper on this subject at the recent Convention of the American Institute of Electrical Engineers. It was the second report to be presented to the Institute on the research investigation of ionisation phenomena in paper-insulated, high-voltage cables, which is being conducted at the Harvard Engineering School under the auspices of the Impregnated Paper-Insulated Cable Research Committee. The power dissipated as ionisation loss in cables is much more harmful than the power dissipated in the solid dielectric. The paper presented methods of separating this ionisation loss from the total dielectric loss occurring in high-voltage impregnated paper cables, the methods having been verified experimentally. The paper consisted essentially of seven parts, as follows:—(1) A description of the apparatus and the method of impregnating cable paper whereby test specimens having practically no occluded gases can be produced. It is necessary to prepare and test samples in this manner in order to determine the law of their dielectric properties over a wide range of voltage gradient. It is only by knowing this law that it becomes possible to separate the ionisation loss in a cable from the total dielectric loss. The experiments show that with three typical, but widely different, types of impregnating compounds, the power factor and capacitance are constant up to gradients as high as from 250 to 300 volts per mil; the power loss is proportional to the voltage squared under these conditions. (2) In order to verify the law of ionisation loss in cables, as determined from the analysis of their dielectric-loss curves, it is necessary to know the character of the ionisation-loss curve for thin air films under conditions of "restricted ionisation." Such curves have been determined experimentally and the characteristics of two air films, of different thicknesses, are given. Above the ionisation voltage, the ionisation loss is a linear function of the voltage. (3) By employing the fact that in a cable the power loss in the solid dielectric varies as the square of the voltage, even above the ionisation voltage, it is simple to separate this loss from the total dielectric loss in a cable, the remainder being the ionisation power loss. The ionisation power-loss curve concaves upwards directly above the ionisation voltage. After all the gas films have become ionised, the curve becomes linear. This is confirmed by a synthetic curve determined from appropriate data. The analysis is given for four different cables having widely varying powers of ionisation, as a result of which the power-loss curves of cables may now be expressed by a very simple equation. It is suggested that the constants of the equations be used as a basis for the quality of cables. (4) Cable models, of glass with intervening air spaces, were made, and their dielectric-loss curves determined as with the actual cables. The analysis of the curves gives results identical with those obtained with actual cables, which seems to verify the results obtained with the cables themselves. (5) It is possible to express the power-factor curve by a simple equation, from which its maximum, &c., may be determined; in reality, the power-factor curve consists of three simple curves. (6) The energy current of a cable may be analysed into three simple components, one of which is determined by the loss in the solid dielectric and the other two by the ionisation characteristics of the cable. (7) The character of the capacitance curve, which varies in different cables, is determined by the positions and thicknesses of the gas films. Further experimental data and study are necessary before an accurate interpretation of the curves can be made.

Purified Textile Insulation.

According to Messrs. H. H. Glenn and E. B. Wood, of the Bell Telephone Laboratories, New York, purification of textiles for telephone wire insulation becomes of general interest when it is appreciated that the improvements obtained by washing are not nullified by the supplementary use of impregnating waxes, or varnishes; that is, the improvement in dielectric properties and reduced electrolysis obtained by washing and by impregnating are apparently substantially additive. While studies have not proceeded far enough to cover comprehensively all the better-known impregnating waxes, asphalts, varnishes, &c., they have proceeded to the point where it can be said that this is the case for the beeswax-paraffin waxes and certain asphaltic compounds. Their findings are in line with the generally-known fact that impregnation of textiles with wax compounds does not prevent, though it does retard, the absorption of moisture which, in the presence of soluble salts, causes conducting paths to be established, probably through the embedded textile fibres. Consequently, such materials as fabric-base insulating tapes, varnished linens and cambrics, electro-magnet coil-winding insulation, all being sensitive electrically to moisture, should benefit to a substantial degree by purification of the fibrous components. Therefore, while there is still much to be learned about the behaviour of silk and cotton with respect to their electrical characteristics under various treatments and conditions, the following statements can be made: (1) The removal of water-soluble salts which are present in both silk and cotton not only results in a very decided improvement in their insulating properties, but also reduces the sensitivity to change of the a.c. characteristics with changes in atmospheric moisture conditions. (2) The improvement which can be realised is great enough to permit the substitution of washed cotton for silk where ordinary commercial silk has been found to give satisfactory results. (3) The use of purified textiles in cables carrying continuous d.c. potential will reduce electrolysis and consequently prolong the useful life of such cables about in proportion to the extent to which the purification process is carried.

Salvaging Electric Lamp Caps.

A new machine, called a "rumbler," has been perfected in the United States for salvaging the brass shells from burned-out electric lamps. One company alone is stated to be dealing with 300,000 lamps per year to obtain the brass shells, which are sold as scrap metal. The old method of reclaiming the metal was to break the lamps by hand: they were put into a barrel, rigged like a churn, and a dasher worked up and down. Breaking the lamps in this way was not only slow and costly, but also too much material adhered to the brass caps, lowering their market value. The new motor-driven rumbler is a long, round machine; a revolving steel cylinder inside is perforated with many holes that are not quite large enough for the brass shells to fall through. About a barrelful of the glass bulbs, from 300 to 500 of all sizes, is poured into the cylinder. Loosely placed among them are two long steel bars, which are covered with prongs. As the rumbler revolves at high speed, the prongs quickly knock the glass, filament wires, and cement loose from the brass shells. The *débris* falls through the holes in the cylinder and the brass shells remain inside the cylinder in a clean and bright condition.

Bournemouth Pavilion Lighting.

In the article under the above heading in our issue of April 5th, reference is made to the stage switchboard which, however, is not illustrated in the article. Fig. 5 shows, as indicated, the power and lighting switchboard.

Preventing Blackening of Lamp Bulbs.

The development of a practical method of removing the black deposit which gradually collects on the inner surface of high-power incandescent lamps has been announced by the General Electric Company in the United States. The effects of the discovery will be of immediate service in the fields of aviation and moving-picture production, in which high-power incandescent lamps play rôles of great importance. Bulb-blackening has always been a significant factor in determining the useful life of all incandescent lamps, and, owing to the large filaments in high-intensity gasfilled lamps, the factor has been most important. The rising gas in such a lamp carries along evaporated tungsten, which is deposited on the cooler top and sides of the bulb; this "soot" both absorbs considerable light, and also radiates heat. In time the glass undergoes de-vitrification, and eventually becomes so hot that the bulb is soon ill-shaped and useless. The new deposit-remover is a tablespoonful of coarse tungsten powder, placed inside the lamp before it is sealed. After the lamp has become blackened through use, it need only be taken from the socket, inverted, and the filament deposit "swept" off the inner glass surface. The lamp is thereby restored to its primal efficiency. With the bulb-blackening difficulty practically removed, it is claimed, the lamp filament may be

heated much nearer to its melting point without endangering the bulb and without shortening the customary 1,000 hours' life for which the lamps are designed. The new method has already been applied to several high-intensity lamps, including 1,500-watt, 32-volt; 3,000-watt, 32-volt; 5,000-watt, 115 volt; and 10,000-watt, 115-volt lamps for aviation service; also to 5,000- and 10,000-watt, 115-volt lamps for moving-picture studios.

Civil Service Commission.

Forthcoming examination for assistant examiners in the Patent Office (20-25).—Regulations and particulars, with forms on which applications must be made, can be obtained up to June 6th from the Secretary, Civil Service Commission, Burlington Gardens, W.1. (See our advertisement pages to-day.)

The Air Route to India.

The wireless organisation for the air mail service to India, which was opened on March 30th, has been completed so that the aircraft will be in touch with aerodrome ground stations throughout the 4,700 air miles of the journey. All the aircraft is equipped with Marconi wireless apparatus, and an intercommunicating chain of ground stations has been arranged. The first section of the route is the London-Basle flight, on which the present wireless organisation for Continental aviation will be employed; it consists of the aerodrome station at Croydon, French stations at Le Bourget, and other intermediate places on the route, and the Marconi station at Basle. The machines are fitted with sets of 150 watts power, type AD6, adapted for communication over distances of from 200 to 300 miles either by telephony or telegraphy. From Basle the night train to Genoa will make the connection with the second section of the air route, from Genoa to Alexandria, for which flying boats fitted with type AD8 sets, also adaptable for telegraphy or telephony, enabling the pilots to keep in touch with Italian and British Air Ministry wireless stations until they arrive at Alexandria. In addition, Imperial Airways, who are conducting the London-Karachi service, have stationed a depôt ship at a point in the Greek archipelago, which has been fitted with a valve transmitter of ¼ kW power (type U) and a type RG19 receiver, and will be capable of communicating with Malta, Alexandria (Aboukir), and other stations concerned with the service. At Alexandria a change is made to aeroplanes again to continue the service over the final section of the route, through Basrah and over the Persian Gulf to Karachi. Over part of this section there has already been in operation for some time De Havilland aircraft fitted with AD6 apparatus for communicating with R.A.F. stations and a ¼-kW station at Rutbah Wells, which was supplied by the Marconi Company to the Iraq Posts and Telegraphs Department. During the flight from Basrah to Karachi, the machines will be in touch with two Marconi stations in Persia (at Chabar and Bunda Abbas). Persian operators for these stations have been trained at the Marconi Company's works at Chelmsford. The terminal wireless plant at Karachi consists of a 6-kW Marconi transmitter with direction-finder receiving apparatus.

Many features of the apparatus for this service have been specially designed to meet the conditions existing on this new Empire route. The constant-speed windmill generator which provides power for the wireless installation will also supply current for the internal and external lighting of the aircraft. In the unlikely event of a forced landing being necessary the same generator can be used to supply emergency power to the transmitter, either by the use of the battery normally used for lighting, or, if it is required to work for long periods, by means of a special coupling to the small petrol engine used for starting the main engines of the aircraft.

Electricity in Rural Areas.

A scheme designed to demonstrate the practicability of supplying electricity to villages and farming areas is under consideration by the Development Commissioners, the Electricity Commissioners, the Ministry of Transport, and the Ministry of Agriculture. It is understood that the area under consideration is a part of the Bedford Corporation's territory, embracing a number of villages, mixed farms, and numerous country residences. The population of the area at the last census was 17,937, and the number of dwellings was 4,573. According to *The Times*, in order to bring electricity within the means of cottagers it is proposed to adopt the hire and hire-purchase systems of payment for the wiring and other equipment. The scheme, it is estimated, can be made self-supporting in about five years, and to assist the Bedford Corporation it is suggested that the Treasury might be asked to make a loan to cover 75 per cent. of the deficit on working in the first four years, repayment of capital and interest to begin when the scheme becomes self-supporting. The underlying assumption is that the success of such a scheme would stimulate rural electrification on a large scale and tend to attract to the cleaner atmosphere of the country many industries dependent on electrical power, thereby assisting to ease both housing and transport congestion in the towns.

The World's Power Resources.

The World Power Conference proposes to establish standard methods and values for assessing the power resources of the world, with the collaboration of 48 countries, and to survey on this basis the world position. It intends also to prepare in the same way statistics of production of coal, coke, oil, gas, water-power, brown coal, and electricity. It was felt, however, that before the work was undertaken an exact study of existing knowledge and statistical data regarding the world's power resources and production should be made, and the basis defined for international work in the future. Such a survey has now been carried out ("Power Resources of the World, Potential and Developed." World Power Conference, £1 1s. net); it has been compiled by Mr. Hugh Quigley, and will be reviewed in due course.

Fatality.

Nicholas George Perring, aged 52, an electrician's labourer employed by the Torquay Town Council, received a fatal electric shock while at work on the sea front on April 4th. With another man he had been engaged in repairing the public lamps attached to an overhead tramway cable, and upon descending from the repair tower entered a small substation in the Rock Walk. There, it is supposed, he came into contact with a live wire, and a few minutes later was found dead by his mate.

Electrical Association for Women.

On March 6th Mr. L. G. A. Sims, M.Sc., gave a lecture to members of the Birmingham Branch of the Electrical Association for Women on "The Economics of Domestic Water Heating." Miss Barrie, head mistress of King Edward's High School for Girls, and one of the vice-presidents of the branch, took the chair. The lecturer emphasised the need of standardisation of plugs and flexibles.

Wired Houses in the United States.

A recent report of the Statistical Department of the National Electric Light Association shows that out of 28,596,000 homes in the United States, 19,057,000, or 66 per cent., are wired for electricity. This is an increase of 1,197,000 over the year 1927. California and New York divide honours for first place, both being credited with more than 100 per cent. of the homes electrified. The record "over 100 per cent" is due to either classification of meters or estimated population. New Hampshire is in second place with 99 per cent. of the homes wired. New Jersey is in the third place with 96 per cent.; District of Columbia, fourth, 94 per cent.; Rhode Island fifth, 92 per cent.; Massachusetts sixth, 90 per cent.; Utah seventh, 89 per cent.; and Connecticut eighth, 88 per cent. Mississippi occupies last place, with only 15 per cent. of the homes wired for electricity.

The Overhead Lines Association.

Attention is drawn to an alteration in the arrangements for the meeting of the O.L.A. on April 24th. On that date Mr. W. Fennell, M.I.E.E., will read a paper entitled "A Review of Ferro-concrete Poles in other Countries," at 5.30 p.m. in the I.E.E. buildings. The change has been necessary to accommodate a modification of the plans of Lieut.-Col. W. A. Vignoles, D.S.O., M.I.E.E., who will deal with "Getting Consumers in Rural Areas" at the May 8th meeting of the Association.

Illuminating Effect Equipment.

An invention of Mr. Louis Alfred Ramsden relates to electrical apparatus for obtaining clear and coloured illumination effects for stage, scenic, advertising and other purposes from a series of clear and coloured lamps. The lamps are constructed with a number of current-carrying sectional filament supports, from each end of which the filament is suspended on one side, the other ends terminating into separate contacts to which connection is made through multiple internal-spring contact devices to multiple-contact lampholders, into the terminals of which a multiple-core cable is connected to carry the current from a combination multiple contact and movement controller in such a manner that the current can be passed wholly through the filament of one lamp or set of lamps, or transferred step by step into another lamp or set of lamps, thus gradually dimming current or colour in one lamp or set and proportionately increasing the current or colour in another group, according to the number of sectional filament supports. For stage or other scenic effects each lamp is constructed with a plurality of current-carrying sectional filament supports, say, six or eight for each lamp, and each lamp is mounted in a lampholder having a contact for each filament support, thus there are six or eight contacts for each lamp. Instead of spring-pushed plunger terminals or contacts in the lampholder, a separate multiple internal-spring contact piece may be adjusted so as to form contact between the filament supports of the lamp and the terminals or contacts of the lampholder. In one form of multiple combination contact and movement controller the contacts for each filament are arranged in the form of a circle concentric with which are two rings connected respectively with the positive and negative of the source of current supply. Two arms are arranged to rotate around the circle, and each arm carries contact makers which connect with the filament contacts and also a second contact maker; one of the arms connects with the positive ring and the other with the negative ring. The two arms are arranged at such an angle apart that they will make contact between terminal contacts equal in number to the sectional filaments of one lamp or set of lamps. By suitable gearing the contact maker may be varied in speed and action at points as it

rotates to give different colour-merging or flashing effects. Other effects may be obtained by interconnecting contacts at different points in the circle.

King's College Centenary Appeal.

In connection with the centenary commemoration this year of the establishment of King's College, University of London (Electrical Review, March 8th, 1928), an appeal is being made for £350,000 to meet requirements for buildings and endowments. The College is now, with the approval of the Senate, acquiring a 200 years' lease of an area of nearly 5,000 sq. ft. above the Aldwych station. Plans have been prepared for the erection on this area of a new building to accommodate several departments, which are now inadequately housed. The attention of our readers is drawn to the special arrangements which are being made to secure endowments for the Chair of Electrical Engineering, which, since the untimely death of Professor J. Hopkinson, F.R.S., in 1898, has been held by Professor Ernest Wilson, and the Chair of Physics, now occupied by Professor E. V. Appleton, F.R.S.

The Engineering Department was founded in 1838, and now forms a separate faculty of the college, comprising departments of electrical, civil and mechanical engineering, each under a professor. During the long history of the college many engineers who later occupied very important positions in the profession received their scientific training within its walls. Through the Engineering Society, a students' organisation which was founded in 1847 and may claim to be one of the oldest of its kind, the close contact maintained between past and present students forms one of the most valued possessions of the college. The Engineering School has always been in the forefront, both in the teaching of the scientific principles of engineering and in the pursuit of original research, yet it has been from the first without endowment. Indeed, unlike most other institutions of the kind, King's College has, throughout the century, been seriously hampered by its pronounced lack of endowment. In contrast with the provincial and older Universities of England, which owe so much to the generous support of benefactors, King's College only receives an annual sum of £4.800 from endowments out of a necessary expenditure of £130,000. This financial embarrassment is emphasised by the ever-increasing number of students.

Since the early period the development of the institution has been continuous. During the 1913-14 session 701 full-time day undergraduate and post-graduate students attended the College, 165 of whom were working for degrees and diplomas in science or in engineering. The further progress made during the post-war years is evidenced by the fact that to-day the number of full-time day students has reached nearly 2,000, of whom about 350 are studying for engineering or science degrees and diplomas. As will be readily understood, this influx of students is putting a severe tax on the available accommodation, and the need of larger premises is becoming more and more imperative every year. We strongly recommend the appeal to the generosity of our readers; donations will be gratefully acknowledged by the Treasurer, King's College, London, W.C.2.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

In the course of a couple of months large numbers of our readers will have come into personal relationship with the newly-appointed Secretary of the Incorporated Municipal Electrical Association. Preparations for the convention which is to take place at Torquay in the first week in June, just as we are all congratulating ourselves or otherwise upon the result of the General Election, are well forward, and between

Mr. J. W. Simpson,
The new Secretary of the I.M.E.A.

now and then the name of Mr. John William Simpson will appear upon many official documents passing through the post, in connection with the proceedings. We therefore take this early opportunity of publishing a photograph of Mr. Simpson and placing upon record particulars of the qualifications and so forth that commended him to the minds of the President and others who had the selection of a Secretary to follow Miss Lanfear, who had for many years carried out so efficiently so much of the Association's secretarial work. Mr. Simpson is 38 years of age, so that if we may be so personal as to say it, he has just reached a period of life which gives one opportunity for greater zest and enterprise than if he were many years older, while it gives him also the opportunity for gaining valuable experience in electrical organisation and knowledge in time to be able to bring them increasingly to bear upon electrical affairs before the curve of his activity begins to decline. He has had considerable administrative and secretarial experience. Twenty-two years' municipal service have brought him intimately into contact with municipal electricity undertakings notably at Tynemouth, Bridlington, and Southwark, where in one official capacity or another he dealt with all matters coming before the Electrical Committees and gained information respecting matters affecting electricity undertakings. He has also had a great deal of experience in dealing with the Electricity Commissioners, the various Government Departments, and Parliamentary Agents. In addition to varied committee work, he has organised a number of conferences appertaining to local government. There are many other parts in Mr. Simpson's career that contribute to impress one with the conviction that the appointment is a wise one, and we wish the new Secretary successful service and the formation of many friendships at this summer's convention.

Mr. S. E. Fedden, M.Inst.C.E., M.I.E.E., M.I.Mech.E., has been appointed district engineer for the Mid-East England Electricity Scheme, 1928, under the Central Electricity Board. He will take up his new duties on May 1st, 1929. Mr. Fedden has been for many years general manager and engineer of the City of Sheffield Electric Supply Department.

Mr. R. Genno, of the electrical maintenance staff at the Michelin Tyre Works, Stoke-on-Trent, who recently sailed in the ss. *Albertic* to Canada, to take up duties with the Hydro-Electric Power Commission of Ontario, was presented with a watch by his colleagues at Stoke.

Mr. W. L. Hambly, late senior heating and cooking representative with the British Electric Transformer Co., has joined the staff of Credenda Conduits Co. as sales engineer for London and South-West England.

At a recent meeting of the Torquay Corporation Electricity Committee, Mr. H. F. G. Woods, borough electrical engineer, submitted his resignation. The Committee, in accepting it, placed on record its appreciation of Mr. Woods's services, and decided to invite applications for a successor at a commencing salary of £850 per annum. We are informed that Mr. Woods is leaving Torquay shortly after the I.M.E.A. Convention to take up the position of general manager to the Exe Valley and East Devon Electricity Supply Companies.

The Dublin City Commissioners, at a special meeting last week, decided, on the occasion of the transfer of the Dublin electricity undertaking to the Electricity Supply Board, to place on record their high appreciation of the skilled knowledge, sound judgment, and business capacity which Mr. Laurence J. Kettle, M.I.E.E., M.I.Mech.E., the engineer

and manager, had exercised during his 23 years' service. They were satisfied that "his single-minded application to duty, coupled with his acknowledged brilliant qualities, had been a main factor in the development and success of the undertaking." A tribute was also paid to the zeal and ability of the staff.

The marriage took place at Edinburgh on March 30th of Mr. E. R. Roberts, of the Transformer Department of Messrs. Bruce Peebles & Co., Ltd., to Margaret, elder daughter of Mr. R. Thompson, mechanical superintendent of Messrs. Bruce Peebles.

The Direct Spanish Telegraph Co. announces that Admiral H. W. Grant, C.B., has been elected a member of the board of the company, and that Mr. J. C. Denison-Pender has been appointed chairman.

We learn that Sir James Devonshire, K.B.E., "having reached the retiring age," has resigned the position of chairman and managing director of the North Metropolitan Electric Power Supply Co., but retains his seat on the board of directors. The Rt. Hon. Lord Ashfield has been appointed chairman of the company, and Sir James Devonshire deputy-chairman.

Col. Sir John W. Pringle, C.B., Chief Inspecting Officer of Railways, retires in May under the age limit. He will be succeeded by Col. A. H. L. Mount, C.B.E., who has been an inspecting officer of railways for the past nine years.

The Kingston-on-Thames Town Council has granted an honorarium of £500 to Mr. T. A. Kingham, borough electrical engineer, for himself and certain members of his staff in recognition of services rendered in connection with the laying of a cable from the borough boundary to Walton-on-Thames.

The Hebden Bridge Urban Cuncil has decided to stabilise the salary of the electrical engineer at £425 per annum. The previous salary and bonus was about £400.

The Wrexham Town Council has increased the salary of Mr. J. W. Williams, borough electrical engineer, from £455 to £500 per annum; that of Mr. E. O. Jones, station superintendent, from £5 per week to £300 per annum; and that of Mr. J. Archer Tippett, consumers' engineer, from £4 10s. to £4 15s. per week.

The marriage was solemnised on April 3rd at Midhurst of Captain G. M. Baker, Nigerian Administrative Service, eldest son of Mr. and Mrs. C. A. Baker, of Croydon, to Beatrice Marjorie, youngest daughter of Mr. and Mrs. G. Knight, of Midhurst.

Mr. James A. Robertson, consulting engineer to the Salford Corporation, has been elected President of the Manchester Association of Engineers.

The *Manchester Guardian* states that the Gold Medal of the Institution of Mining and Metallurgy has been awarded conjointly to the Hon. W. Baillieu and Mr. W. S. Robinson "in recognition of their services in the development of the mineral resources of the Empire, with special reference to the zinc and lead industries of Australia."

The Chester Electricity Committee has appointed Mr. E. F. Humphrey, of Birmingham, as an additional mains superintendent at a basic salary of £324 per annum.

The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board has passed a resolution of appreciation of the services of the chief engineer, Mr. R. Blackmore, who, as already announced, is leaving after 25 years' service to take up a position with the Central Electricity Board.

Mr. Frank Thoday, of the Tunbridge Wells Corporation Electricity Works staff, was married at Eastbourne on March 30th to Miss Evelyn Hollobon. Mr. Thoday's colleagues presented him with an oval mirror.

Mr. and Mrs. Magnus Volk, of early electric railway fame at Brighton, celebrated their golden wedding on April 8th.

Obituary.—Mr. T. H. Plowright.—The death has taken place, after being knocked down by a runaway horse, of Mr. Thomas Henry Plowright, who had for 27 years been on the staff of the Windsor Electrical Installation Co. He was 58 years of age, and was chief assistant engineer to Mr. A. E. Farrow, until the recent change of management, when he continued to act as station charge engineer at the works.

Mr. A. C. Meyjes.—We record regretfully the passing, at the age of 70 years, of an old comrade of the trade and technical Press, Mr. Cornelius Antonie Meyjes, who was with Messrs. Morgan Bros., the proprietors of the *Chemist and Druggist* and the *Ironmonger* in editorial capacities for close upon forty years. He was on the staff of the *Chemist and Druggist* from 1885, until Mr. W. E. Freir (who passed away last year) retired and started a journal of his own in 1898. Mr. Meyjes followed Mr. Freir as editor of the *Ironmonger*, and it was in that capacity that present-day trade journal editors and some members of the electrical trade got to know him best and to recognise in him a man who was fearless and independent with regard to the contents of his journal and possessed of a very sound judgment as to the kind of matter that readers of the *Ironmonger* required. Mr. Meyjes retired in 1924, after the death of his wife.

Sir C. T. Mander, Bt.—We have to record the death, at the age of 77 years, of Sir Charles Tertius Mander, Bt., of Wolverhampton. In business he was a partner in the family business of Mander Brothers, varnish and colour makers. Sir Charles rendered lengthy and prominent public service. His activities on the Council, in connection with tramway affairs, brought him into contact with electrical men. He was Mayor of Wolverhampton for four years.

Mr. P. J. Powell.—The death is announced at the age of 82 years of Mr. Peter James Powell, who was for about 40 years associated with the business of Messrs. E. T. Mackrill and Sons, electrical engineers and contractors, of Aylesbury. He assisted in the foundation of the business.

Mr. J. W. Lewsley.—The death took place on March 22nd, at London Road, Derby, of Mr. John Wilfred Lewsley, A.M.I.E.E. Mr. Lewsley was 50 years of age, and was connected with the electrical department of the London, Midland and Scottish Railway Co.

Mr. R. H. Benson.—We regret to record the death of Mr. Robert Henry Benson, the well-known banker, who had for so long a period been closely connected with electricity supply company interests in London. Mr. Benson, who was 79 years of age, was chairman of the London Electric Supply Corporation, Ltd., the St. James' and Pall Mall Electric Light Co., Ltd., and a director of the Anglo-American Telegraph Co., Ltd.

Mr. C. N. Waters.—We regret to record the death at the early age of 39 years of Mr. C. N. Waters, who joined the staff of the Chloride Electrical Storage Co., Ltd., nine years ago, and was head of the electro-chemical and physical laboratory.

Will.—The late Mr. John Marshall Gorham (of Drake and Gorham, Ltd.), whose death and career were recorded here in January, left £145,638 gross and £134,900 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

J.H.B., Ltd.—Private company. Registered March 28th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus and accessories, phonographs, gramophones, &c. The directors are:—J. H. Benjamin, 19, Lancaster Gate Terrace, Hyde Park, W.2; H. Weber (managing director), 114, Tollington Park, Finsbury Park, N.4. Registered office: 59, Gresham Street, E.C.

Hardyson Radio, Ltd.—Private company. Registered March 28th. Capital, £5,000 in £1 shares. Objects: To acquire any patents relating to the manufacture of wireless sets, combined wireless and gramophone sets, television apparatus, combined television, and sound-producing apparatus, and to carry on the business of designers and manufacturers of and dealers in wireless sets, combined wireless and gramophone sets, &c. The permanent directors are:—J. Dyson, 250, Longwood Road, Huddersfield; C. Hardy, 10, Ravens Crescent, Dewsbury; N. Stott, 6, Hillside Avenue, Fartown, Huddersfield. Solicitors: Cartwright & Fieldhouse, Huddersfield.

Volcanic Sparking Plugs, Ltd.—Private company. Registered March 30th. Capital, £15,000 in £1 shares. Objects: To acquire from E. J. Buckingham and P. C. Knott an exclusive licence to use an invention relating to improvements in or connected with sparking plugs, &c. The directors are:—P. C. Knott (managing director), Lyndhurst, Pooley Green Road, Egham, Surrey; E. J. Buckingham, 3, Hanover Gardens, Camberwell, S.E.; J. E. Jowitt, Ascot Lodge, Walton-on-Thames. Registered office: Chandos House, Buckingham Gate, S.W.1.

Rural-Volts, Ltd.—Private company. Registered March 27th. Capital, £10,000 in 1s. shares. Objects: To install apparatus for the distribution of energy running across country or in any town, village, residence or place within the United Kingdom, to deal in wireless apparatus, to carry out research connected with the adaptation of electricity to agriculture, horticulture, and any process connected with farming, &c. The subscribers are:—C. H. E. Coles, Deep Dene, Tumblewood, Banstead, engineer; B. S. Hooker, Leyswood, Copthorne Road, Leatherhead, secretary to public company. The first directors are:—C. H. E. Coles and G. J. Gainsford. Secretary: B. S. Hooker. Solicitors: W. H. Smith & Son, Gresham House, Old Broad Street, E.C.

Rotor Signs (England), Ltd.—Private company. Registered March 30th. Capital, £5,000 in 5s. shares. Objects: To adopt an agreement with T. H. Read, and to develop and turn to account the patents referred to therein. The subscribers (each with one share) are:—R. Martin, 41, Bourne Hill, Palmers Green, N.13, accountant; E. Butler, 13, Sprules Road, Brockley, S.E.4, accountant. Registered office: 4, Dove Court, Old Jewry, E.C.

Grange Electrical & Radio Services, Ltd.—Private company. Registered in Edinburgh on April 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of contractors, engineers, electricians, builders and constructors of and dealers in motors, &c. The directors are:—J. C. Todd, 55, St. Albans Road, Edinburgh, motor engineer and garage proprietor; G. E. Haig, 11, Newington Road, Edinburgh, electrical engineer; J. D. Cochrane, 29, Falcon Gardens, Edinburgh, insurance inspector. Secretary: J. C. Todd. Registered office: 1, Grange Road, Edinburgh.

Official Returns of Electrical Companies.

C. Barnett, Ltd.—Second debenture dated March 11th, 1929, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital (subject to a prior charge for £1,000). Holder: F. T. Smith, 52, Bedford Square, W.C.1.

Chloride Electrical Storage Co., Ltd.—Satisfaction in full on March 16th, 1929, of debenture dated December 29th, 1928, securing all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Bridgwater and District Electric Supply and Traction Co., Ltd.—Satisfaction in full on March 20th, 1929, of first debentures dated between January 31st, 1905, and August 25th, 1915, securing £13,050.

Satisfaction in full on or before March 20th, 1929, of third debentures, dated April 16th, 1924, securing £1,150.

Western Telegraph Co., Ltd.—Capital, £3,500,000 in £10 shares. Return dated December 20th, 1928. 311,895 shares taken up. £2,339,650 paid. £779,300 considered as paid. Mortgages and charges, £818,675.

Hazeltine Neutrodyne Radio Sets, Ltd.—Capital, £5,000 in £1 shares. Return dated January 2nd, 1929. 4,900 shares taken up. £1 per share called up on 2,550 shares and nil on 2,350 shares. £2,550 calls unpaid. Mortgages and charges, nil.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.—Capital, £1,250,000 in 750,000 ordinary, 250,000 preference, and 250,000 unissued shares of £1 each. Return dated December 13th, 1928. 750,000 ordinary and 250,000 preference shares taken up. £1,000,000 paid. Mortgages and charges, £400,000.

Venezuela Telephone and Electrical Appliances Co., Ltd.—Capital, £280,000 in 140,000 preference and 140,000 ordinary shares of £1 each. Return dated December 26th, 1928. 136,975 preference and 136,975 ordinary shares taken up. £217,444 paid on 136,975 preference and 80,469 ordinary shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £145,300.

St. Austell and District Electric Lighting and Power Co., Ltd.—Capital, £20,000 in 13,000 preference and 7,000 ordinary shares of £1 each. Return dated October 26th, 1928 (filed February 1st, 1929). 13,000 preference and 6,700 ordinary shares taken up. £19,700 paid. Mortgages and charges, £20,094 8s. 11d.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative preference, 5,000 "A" ordinary, and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1928. 3,907 "A" ordinary shares taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

Stratford Auto and Wireless Co., Ltd.—Debenture dated March 19th, 1929, to secure £315, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Barclay's Bank, Ltd.

Bullers, Ltd.—Capital, £400,000 in 20,000 preference and 20,000 ordinary shares of £10 each. Return dated January 3rd, 1929. 15,000 preference and 15,593 ordinary shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £204,250.

Metallic Seamless Tube Co., Ltd.—Capital, £65,333 6s. 8d. in 20,000 preference shares of 13s. 4d. each and 260,000 ordinary shares of 4s. each. Return dated December 24th, 1928. 15,245 preference and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid on 15,245 preference and 130,000 ordinary shares. £26,000 considered as paid on 130,000 ordinary shares. Mortgages and charges, nil.

Rotax (Motor Accessories), Ltd.—Capital, £506,500 in 253,250 preference and 253,250 ordinary shares of £1 each. Return dated July 11th (filed September 20th), 1928. 253,034 preference and 253,250 ordinary shares taken up. £168,867 paid on 75,000 preference and 93,867 ordinary shares. £337,417 considered as paid on the remainder. Mortgages and charges, nil.

New Phonopore Telephone Co., Ltd.—Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. Return dated December 26th, 1928. 7,141 ordinary and 1,000 founders' shares taken up. £6,741 paid. £1,400 considered as paid. Mortgages and charges, £2,666 13s. 4d.

Border Electrical Factoring Co., Ltd.—Mortgage on freehold land and buildings, &c., at Carlisle, dated March 18th, 1929, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Power Construction Co. Ltd.—Three mortgages dated March 18th, 1929, to secure £3,325, £3,325 and £3,800 charged on properties in Farnham Royal, Bucks. Holders: Portman Building Society, 14, Orchard Street, W.

Southern Electric Free Wiring Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 19th, 1928. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

Imperial United Lamp Co., Ltd.—F. W. Kellaway, Thanet House, 231-2, Strand, W.C.2, ceased to act as receiver and manager on March 22nd, 1929.

Marconi's Wireless Telegraph Co., Ltd.—Capital, £4,000,000 in 499,935 ordinary and 250,000 7 per cent. cumulative participating preference shares of £1 each and 3,250,038 ordinary shares of 10s. each, and 3,250,092 unclassified shares of 10s. each. Return dated December 31st, 1928. 395,114 £1 ordinary, 3,250,038 10s. ordinary, and 250,000 preference shares taken up. £1,797,484 10s. paid on 3,094,969 10s. ordinary and 250,000 preference shares. £472,648 10s. considered as paid on 155,069 10s. ordinary and 395,114 £1 ordinary shares. Mortgages and charges, £400.

Central Radio (Eastbourne), Ltd.—Capital, £500 in £1 shares. Return dated March 19th, 1929. 112 shares taken up. £112 paid. Mortgages and charges, £1,050.

Implitico, Ltd.—Capital, £3,000 in £1 shares. Return dated December 21st, 1928. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

E. Shipton & Co., Ltd.—Capital, £6,000 in 4,000 preference and 2,000 ordinary shares of £1 each. Return dated January 11th, 1929. All shares taken up. £300 paid. £5,700 considered as paid. Mortgages and charges, nil.

George Hill & Co., Ltd.—Capital, £4,000 in £1 shares. Return dated January 12th, 1929. 2,150 shares taken up. £2,150 considered as paid. Mortgages and charges, nil.

C. F. Casella & Co., Ltd.—Capital, £17,000 in 2,000 preference and 15,000 ordinary shares of £1 each. Return dated November 16th, 1928 (filed January 3rd, 1929). 2,000 preference and 12,204 ordinary shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges, £1,500.

City Notes.

Clyde Valley Electrical Power Co.

This company's report was reviewed in our issue of March 22nd (p. 535). The annual meeting was held on April 3rd, when Sir Frederick C. Gardiner, K.B.E. (chairman), who presided, said that although there were certain signs of recovery in the industries of the company's area, they still awaited the general revival which would quickly and favourably affect the operations of the company. In dealing with the accounts, the chairman said that the reduction in fuel costs was due partly to the fuller benefit derived from the increasing production of the Lanarkshire Hydro-Electric Power Co.; that

factor was also mainly responsible for the larger quantity of purchased energy. The coupling-up of their system to the "grid" necessitated the replacement of obsolete sub-station switchgear at an earlier date than originally anticipated. The increase of about 21 million kWh was due mainly to the expansion of the domestic load; the company now supplied, directly or indirectly, about 40,000 consumers. During the year extensions were made to and supply was commenced in Uplawmoor and Eaglesham, and extensions to Lochwinnoch and Shotts were in hand. Keeping pace with the demand involved continuous capital outlay. At present they were increasing the boiler capacity at Clyde's Mill; that should lower the generating costs. A 20,000-kW turbo-alternator was being added to the Yoker plant; this operated at 50 cycles in anticipation of the change in frequency. The cable system had been reinforced and extended in various directions. The current year had opened favourably; there was a continuous flow of new contracts from domestic consumers, and the output for the first quarter showed an advance of 7 per cent. over that for the corresponding period of last year. The institution of a new method of charging last year had given rise to misconceptions, and to prevent any possible hardship to consumers they had been given the option of remaining on the old system if they desired. Already, however, a large number had adopted the new system, and he thought that in time a large majority would find it to their advantage to do this. They had engaged a special staff for the work of changing the frequency from 25 to 50 cycles, and it was hoped that the extreme western portion of the area would be changed over by the end of this year. It was practically certain that before the next annual meeting the Yoker and Clyde's Mill stations and the two water-power stations of their subsidiary, the Lanarkshire Hydro-Electric Power Co., would be vested in the Central Electricity Board, and the company would then re-purchase all the energy which it required at a price not less favourable than that at which it could itself generate the energy. The company had largely overspent its capital, and it was therefore considered desirable to issue the balance of the authorised capital (£900,000). It was proposed to offer this as ordinary shares at par to the ordinary shareholders in the proportion of three new shares to each four held. The report and accounts were adopted.

Ericsson Telephones, Ltd.

Mr. W. M. Crowe (chairman and managing director) presided at the annual meeting on April 3rd. In presenting the report and accounts (ELEC. REV., March 29th, p. 579), he said that the net profit had risen by about 15 per cent., and the prospects for the current year were very favourable. They had now entered fully into the manufacture of automatic telephone equipment for which there would be a good demand for many years to come. During last year and since the beginning of this year they had received some large orders for automatic equipment as well as for general telephone material and manual exchanges. For the Post Office they had completed and installed an automatic exchange at Bath with two satellite exchanges. They had also completed automatic exchanges at Walsall, Aldridge, and Bloxwich; these would be opened in the near future. The Shepherd's Bush exchange was also well advanced at their works, and installation had commenced. Further exchanges in hand were Crewe and Nantwich and the "Gladstone" (London) exchange. Orders had been secured at home and abroad for large private automatic exchanges. Many improvements in the automatic equipment were being developed, and these should yield benefits before long. Although they were securing business in the Colonies, the prices for certain classes of materials were cut to the finest margin, and in many cases there was no profit. This country had a long way to go before it reached the same telephone standard as other up-to-date countries, but progress was being made. The Treasury had not been over-liberal in the past, but pressure was being brought to bear to secure more funds for this important development. The chairman suggested that the Chancellor of the Exchequer might devote a part of his Budget surplus to this remunerative work to relieve unemployment and benefit industry. With practically no additional capital expenditure on machinery, &c., the company could give employment to double the present number. In reviewing the accounts, the chairman pointed out in the balance-sheet a new item—shares in a new company. That, he said, was an investment in a concern for which they were to manufacture an article of much utility. The report and accounts were adopted.

Llandudno and Colwyn Bay Electric Railway, Ltd.

The accounts for the year ended December 31st last show that after providing for loan interest there is a deficit of £1,153, as compared with a surplus of £332 for 1927. Owing to the attitude of the Colwyn Bay Council, the proposed reconstruction of a section of the track has not been proceeded with. The company has been unable to make reasonable arrangements with the Council and the loss of revenue due to omnibus competition accounts for the unsatisfactory financial results. At the instance of the Colwyn Bay Council, the company was recently fined on account of the condition of track which, the company maintains, is on private land. It is hoped that some satisfactory settlement of the matter will be reached. The directors state that they may have to take steps to secure protection against unwarranted and unnecessary competition. Mr. A. W. R. Lovering, the secretary of the company, has been appointed to the board in the place of Mr. A. W. Tait, and Sir Joseph Nall has been elected chairman.

Windermere and District Electricity Supply Co., Ltd.

The report for the past year states that in December last it was resolved that 20 per cent. of the arrears on the 6 per cent. cumulative preference shares should be cancelled and that the holders should receive in lieu of the remainder one 7½ per cent. non-cumulative preference share for each five 6 per cent. shares held; these non-cumulative preference shares were paid up out of reserve. The Electricity Commissioners gave their consent to the installation of a 300-h.p. Diesel alternator, and the erection of this is nearing completion. The lighting charge was reduced by 1d. per kWh during the year. The revenue account shows a balance of £8,740, and, with the amount brought forward, interest and dividends, the sum available is £11,628. After the usual allocations the directors propose to pay a total of 9 per cent. on the 6 per cent. cumulative preference shares to discharge all arrears, and to pay the full year's dividend on the 7½ per cent. preference shares; this leaves £803 to be carried forward.

Keswick Electric Light Co., Ltd.

After adding £322 brought forward and deducting debenture interest, &c., there is an available balance of £2,626. Of this, £1,926 is absorbed by writing down charges and allocations to reserves. The ordinary dividend is 10 per cent.

South London Electricity Supply Corporation, Ltd.

The revenue account for the year ended December 31st, 1928, shows a balance of £115,385, to which is added £65,683 brought forward, making £181,068. From this debenture and loan interest are paid, £15,000 is put to taxation reserve, and allocations are made to sinking and contingency funds. The preference dividend is paid and a final distribution of 5½ per cent. is to be made on the ordinary shares (making 8½ per cent. for the year), leaving £95,397 to be carried forward, subject to the operation of the London Electricity (No. 1) Act, 1925, and prospective reductions in charges. The sales of energy during the year rose from 17,100,275 to 19,580,122 kWh. The £130,000 5 per cent. mortgage debenture stock has been discharged. Mr. R. B. Renwick has been appointed a director. Meeting: April 16th.

Chelsea Electricity Supply Co., Ltd.

The net profit for the year ended December 31st last, after providing for debenture interest and sinking and contingency funds, is £82,227. The preference and standard ordinary dividends are paid, £5,069 is transferred to special reserve (shareholders' proportion of consumers' benefit for 1926, 1927 and 1928), and £16,220 to employés' pension fund, leaving £24,039 to be carried forward. The connected load increased by 597 kW to 14,048 kW, and the sales of energy rose by 653,692 kWh to 9,465,940 kWh. After yesterday's annual meeting extraordinary meetings were to be held to pass resolutions empowering the directors to capitalise and distribute reserves, and to authorise them to capitalise £8,989 of the special reserve fund and to allot this in the form of £1 ordinary shares "to such persons and in such manner as the directors shall think proper to be held on account of the pension fund formed for the benefit of the employés of the company."

General Electric Co., Ltd.

It was announced last week that the discussions between Sir Hugo Hirst, Bt., and Mr. M. J. Railing for the company, and Messrs. T. L. Chadbourne and H. B. Swope, representing the company's American shareholders, had had to be postponed on account of Mr. Chadbourne's illness.

The following statement was issued by the company on Saturday last:—

"We are not engaged in any negotiations with Associated Electrical Industries, Ltd. We are exploring every avenue to secure friendly agreement with the American shareholders, but there is no plan under consideration which suggests transfer of the control of the G.E.C."

This apparently had reference to rumours which have been current for a long time and were revived in a somewhat sensational form in the financial Press last week.

Lanarkshire Tramways Co.

In their report for 1928 the directors state that intense competition again prevailed during the year, and it is impossible under present conditions to successfully compete with motor-'buses. The company is therefore seeking powers to abandon its tramways in sections; to cancel its wayleaves and other obligations in connection with the tramways; to secure the restriction of motor-'bus competition, &c. The net revenue account shows that an adverse balance of £9,497 was brought forward, and the payment of debenture and loan interest, &c., brought this up to £13,724. Against this is placed a balance of £7,725 from revenue account, leaving a deficit of £5,999 to go to the balance sheet. Although the car-mileage increased from 3,837,864 to 4,057,214, the number of passengers carried fell from 23,351,573 to 19,851,508.

Electric Furnace Co., Ltd.

On Monday last this company published, for information only, a statement of its constitution and objects. It was formed in August, 1928, to take over the business of a company of the same name (formerly Campbell, Gifford & Co., Ltd.). It has a capital of £200,000, half in preferred ordinary shares and half in ordinary shares, all of £1 denomination. Of these, 80,007 preferred ordinary and 78,036 ordinary shares have been issued. The preferred ordinary shares are entitled to a fixed cumulative preferential dividend of 7 per cent. and to a further 3 per cent. which is also paid on the ordinary shares. The company contracts for installations of electric furnace plant, and either owns or is licensed to use a number of patents covering a wide variety of electro-metallurgical applications. Among the furnaces so installed by the company are the Héroult, the Ajax-Wyatt, and the Ajax-Northrup. The directors are Mr. D. F. Campbell (chairman), Mr. W. S. Gifford, and Lt.-Col. the Hon. O. H. Stanley. The registered office is at 17, Victoria Street, S.W.1.

South Metropolitan Electric Light and Power Co., Ltd.

The balance on the revenue account for the past year was £192,441, and to this is added £118,247 brought forward, making £310,688. The allocations include £10,000 to staff superannuation fund, £20,000 to taxation reserve, debenture interest, sinking funds, &c., and the balance remaining for dividend is £219,576. The final ordinary dividend is 5½ per cent. (making 8½ per cent. for the year), and £152,076 remains to be carried forward, subject to the operation of the London Electricity (No. 1) Act, 1925, and prospective price reductions. The sales of energy rose from 34,285,242 to 39,152,112 kWh. During the year considerable reductions were made in charges. The report records the death of Sir James Hosker, one of the directors. Meeting: April 16th.

Canadian Hydro-Electric Corporation, Ltd.

The first financial report of this company, which controls the Gatineau Power Co., the Gatineau Electric Light Co., and the St. John Power Co., shows gross income for the year ended December, 1928, including other incomes, as $4,367,393. Operating maintenance and all expenses totalled $874,383, leaving a revenue of $3,493,009. The net revenue after all deductions was $776,063, which, added to the previous surplus of $6,066,669 brought forward, made a total surplus of $6,842,732. It is stated that the subsidiaries of the company had a capacity of 622,600 h.p. installed or in process of installation. Extensions to the plant of the Gatineau Power Co., the largest of these subsidiaries, will bring its total capacity up this year to 562,000 h.p.

Salisbury Electric Light and Supply Co., Ltd.

After meeting debenture interest, taxation and depreciation, and adding £92 brought forward, the balance on the past year's working was £9,502. It was proposed to place £600 to reserve; to pay a final dividend of 6 per cent., free of tax, on the old shares (making 10 per cent., tax free, for the year); and to pay a dividend for six months at the rate of 10 per cent. per annum, free of tax, on the new shares, leaving £152 to be carried forward. The supply to Wilton was commenced during the past year, and the extensions in the Salisbury area have been completed. Mr. A. J. Fippard has been appointed to the board.

Woking Electric Supply Co., Ltd.

The balance on working for the past year, plus £1,344 brought forward, is £41,969. After meeting debenture charges and preference dividends, transferring £10,000 to depreciation and renewals fund, £5,000 to reserve, £5,000 to change-over account, and £2,313 to capital expenditure account, it is proposed to pay a dividend of 7½ per cent., free of tax, on the ordinary shares (against 10 per cent., free of tax, for 1927) and to carry forward £1,851. The sales of energy increased from 4,815,108 to 5,431,760 kWh. The directors have capitalised £21,760 of the reserve fund, and this has been allotted to the ordinary shareholders in the form of ordinary shares.

Brompton and Kensington Electricity Supply Co. Ltd.

The report for the year ended December 31st last states that the connections rose from 23,212 to 25,459 kW and the sales of energy from 7,579,261 to 8,645,664 kWh. After providing the statutory amounts for the sinking and contingency funds and adding the balance brought forward, the net revenue is £52,885. The preference dividend is paid, £5,503 is transferred to the special reserve fund (ordinary shareholders' proportion of the consumers' benefit for 1926, 1927 and 1928), and the balance (10.706d. per share) of the standard ordinary dividend is paid, leaving £16,579 to be carried forward. The meeting was to be held yesterday (Thursday).

G. D. Peters & Co., Ltd.

The net profit for the past year was £8,228, and to this is added £7,724 brought forward, making £15,952. After allocating £1,200 to income-tax reserve, it is proposed to carry forward the balance of £14,752.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the Register, and they are thereby dissolved:—

Benbat Radio Co., Ltd.
Boston Wireless & Electrical Co., Ltd.
Electrical Co., Ltd.
Electrical Displays & Accessories, Ltd.
Excelsior Electrical Co., Ltd.
Lumos Radio Valve Co., Ltd.
New Wireless League, Ltd.
Southampton Wire & Cable Manufacturing Co., Ltd.
"Walco" Electrical Co., Ltd.

Canadian General Electric Co., Ltd.

The annual report for 1928 indicated that the company had enjoyed the most successful operating year in its history. Net profits, after deducting for reserves, taxes, and depreciation were $3,695,665, as compared with $2,103,053 in 1927, an increase of $1,591,612, or 75 per cent. The sum of $599,042 was distributed in dividends, leaving a surplus of $3,195,623. A special appropriation of $2,855,871 was made for deduction in the plant and property values, leaving a surplus of $229,752, which, added to the amount brought forward, made a total surplus of $3,204,625. During the year the company expended $892,641 for additional machinery and equipment, enabling it to enlarge its manufacturing facilities.

Lancashire Electric Light and Power Co., Ltd.

To meet the capital expenditure upon recent general developments, including the Kearsley station which is expected to be in operation later this year, the directors propose to raise the company's capital to £3,171,415 by the creation of 600,000 ordinary shares of £1 each. These will rank for dividend as from April 1st, and will be offered in the first place to present shareholders. The necessary resolution is to be placed before a meeting of shareholders to-day (Friday).

River Plate Electricity Co., Ltd.

The net revenue shown in the 1928 report is £53,400, representing an increase of £1,760. The ordinary dividend is maintained at 11 per cent., £6,794 is placed to reserve, and £7,403 is carried forward. During the year 67,000 shares were created; of these, 63,814 were issued as a bonus to shareholders, and 3,186 were sold at a premium totalling £3,185, which has been added to reserve. The latter now stands at £310,000.

Shanghai Electric Construction Co., Ltd.

The directors recommend a final dividend of 7½ per cent., free of tax, making 12½ per cent. for the year, free of tax, as against 12 per cent., less tax, for 1927. They also propose to raise the capital from £500,000 to £700,000, to capitalise £100,000 of undivided profits, and to issue this in the form of fully-paid £1 shares to present shareholders in the ratio of one new share for each five held.

London Electric Wire Co. & Smiths, Ltd.

The report for the year ended December 31st last records a profit of £110,276, as compared with £75,614 for 1927. To this is added £20,789 brought forward, making £131,065. The allocation to general reserve is increased from £20,000 to £30,000, and a final dividend of 6¼ per cent. (again making 7½ per cent. for the year) is to be paid on the ordinary shares, leaving £22,759 to be carried forward.

American Telephone and Telegraph Corporation.

At the general meeting on April 20th the directors will ask for the shareholders' approval to the issue of new bonds to the extent of $225,000,000. These will be offered to the shareholders on favourable terms, and the proceeds will be employed largely for the financing of new construction work.

Associated Gas and Electric System.

The report for 1928 shows that the gross earnings rose from $35,296,741 to $42,163,550 and the net earnings from $17,032,086 to $19,170,637. After meeting interest, preferred dividends and depreciation, there remains $6,498,592 for dividends and surplus, against $6,258,653.

Hong Kong Tramway Co., Ltd.

The profit for the past year fell from $982,838 to $970,940; $252,849 brought forward is added, making $1,223,789. The dividend for the year is maintained at $1.40 per share by a final distribution of $0.80 per share; $68,000 is written off goodwill; and $245,789 is carried forward.

Commonwealth Power Corporation.

The gross earnings of this company and its subsidiaries rose from $53,172,976 in 1927 to $58,504,122 last year, and the net income from $12,413,628 to $16,296,471. During last year four quarterly dividends totalling $3.25 per share were paid on the common stock.

Atlas Light and Power Co., Ltd.

An interim dividend of 2 per cent. has been declared on the ordinary shares, as last year.

The Cable-Wireless Merger.

In connection with the amalgamation of the cable and wireless interests two public companies, each with a nominal capital of £100, were registered on April 8th. The first bears the title "Cables and Wireless, Ltd.," and power is taken to increase the capital by ordinary resolution to £53,700,000 in 23,500,000 5½ per cent. cumulative preference shares, 21,200,000 7½ per cent. non-cumulative "A" ordinary shares, and 9,000,000 "B" ordinary shares, all of £1 each. This is the holding company. The second one—"Imperial and International Communications, Ltd.," is to acquire the assets of the companies concerned and the State-owned cable and beam wireless systems. The basis of exchange of holdings in the merged companies for existing stocks and shares is as follows: *Cable companies.*—For each £100 of ordinary stock in the Eastern Telegraph Co., Ltd., or each £100 of ordinary shares of £10 each in the Eastern Extension, Australasia and China Telegraph Co., Ltd., or each £100 of ordinary shares of £10 each in the Western Telegraph Co., Ltd.: £165 of 5½ per cent. cumulative preference shares, £108 18s. of 7½ per cent. "A" ordinary shares, and £26 of "B" ordinary shares.

Marconi's Wireless Telegraph Co., Ltd.—For each £100 of 7 per cent. cumulative participating preference shares, or each £100 of ordinary shares of £1 each: £131 10s. of 5½ per cent. cumulative preference shares, £205 8s. of "A" ordinary shares, and £150 5s. of "B" ordinary shares. For each £50 of ordinary shares of 10s. each: £81 10s. of 5½ per cent. cumulative preference shares, £205 8s. of "A" ordinary shares, and £150 5s. of "B" ordinary shares.

Fuller details of the scheme will appear in our next issue.

Alton Battery Co., Ltd.

The directors have declared a final dividend of 5 per cent. on the ordinary shares (making 8 per cent. for the year) and 8 per cent. on the deferred shares in respect of the year ended December 31st, 1928.

Mexican Light and Power Co.

The dividends have been declared in respect of the half-year ending April 30th on the 7 per cent. cumulative preference shares and the 4 per cent. cumulative redeemable second preference shares.

Scottish Southern Electric Supply Co., Ltd.

The capital of the company has been increased, making the total capital issued £120,000 in 6 per cent. cumulative preference shares and £80,000 in ordinary shares.

Dutch Company.

The report of the *Hengelosche Electrische en Mechanische Apparatenfabriek* ("*Heemaf*") states that an improvement in the trade situation took place in 1928. An increasing demand was expected for wire, cables, and electrical machinery and apparatus. Measures were being taken in England of such a nature that in co-operation with an English works good results might be expected in the future, especially in view of the change-over in England from d.c. to a.c. The accounts show a credit balance of 631,000 florins, as against 535,000 fl. in 1927, and the dividend remains at 5 per cent.

German Companies.

The *Saxony Works Light and Power Co.*, Dresden, reports a further favourable development in 1928, the value of the turnover having increased by 20 per cent. The net profits amount to 1,430,000 marks, against 1,150,000 marks, and the dividend on the "B" shares is 10 per cent. (9½ per cent. in 1927) and 7.5 per cent. (7 per cent.) on the other shares.

The *Voigt and Haeffner Co.*, Frankfort-on-Main, reports that after the measures adopted in 1927 the company was prepared for a greater amount of business, and was able to obtain a materially larger turnover without any noteworthy increase in the number of persons employed. In the autumn of last year a decline set in, and at present the arrival of orders shows a diminution. With the declining activity increased competition has set in, with falling prices. The net profits rose from 730,000 marks in 1927 to 810,000 marks last year, and the dividend is advanced from 8 to 9 per cent.

The *Bergmann Electricity Works Co.*, Berlin, reports net profits of 4,480,000 marks for 1928, as compared with 4,470,000 marks in the preceding year. It is proposed to maintain the dividend at 9 per cent.

The *Mix and Genest Co.*, Berlin, proposes to pay a dividend of 8 per cent. on the old share capital of 9,500,000 marks for 1928, against 9 per cent. in the previous year, and 4 per cent. on the new capital of 6,500,000 marks.

French Companies.

The *Compagnie d'Electricité Industrielle* records a gross surplus of 7,336,000 fr. for 1928, this amount being balanced in the profit and loss account by the financial charges and taxes on securities.

The *Compagnie Générale d'Electricité*, Paris, reports net profits of 20,993,000 fr. for 1928, as compared with 25,327,000 fr. in the preceding eighteen months. It is proposed to pay a dividend of 17 per cent., against 14 per cent.

Stocks and Shares.

Monday Evening.

Stock Exchange markets are shaking off by degrees their allegiance to financial conditions ruling in America. It is true to say that trans-Atlantic gamblers are very much quieter than they were even a month ago. The Federation which rules the banking business of the whole of the United States has issued a brusquely-worded warning on the subject of over-speculation. This served to emphasise the previous impression that the American banks are now in earnest over their declared policy of curtailing credit for stock market purposes. Further liquidation of weak accounts has led to a transfer of stock from one set of hands into another set financially stronger. The latter are under no necessity to pay extravagant rates of interest for money. The scramble for financial accommodation is past. With it has gone the immediate fear of a rise in the Bank of England rate. So investment prices are better.

The Cable Quartette.

The outstanding feature in the stocks and shares quoted overleaf is the manner in which Eastern Cable shares have improved. Eastern Telegraph ordinary rose 12¼ points to 280: less than a month ago the stock could have been bought at 255. Eastern Extensions are 30s. up at 28½. Westerns have risen 27s. 6d. to 28½. Globe Telegraph and Trust ordinary, lagging a little behind the rest of the group, are £1 up on balance at 27½. Explanation of these gains is to be found in the report that when the Communications Company scheme is unfolded—as is likely before these pages are—the three cable companies' issues will be found worth about £300 for Eastern ordinary stock, and £30 per share for Eastern Extensions and Westerns. The Globe Telegraph and Trust, as a holding concern, is expected to be left in its present state, instead of having its shares exchanged for new securities. American Telephone and Telegraph at 225 and International Telephone and Telegraph at 265, have gone back several points from the best prices recently touched. In which connection it may be well to correct the statement, made last week, that Kreuger and Toll, which is contemplating entry into the telephone business, is a match-manufacturing concern; it is more in the nature of a trust company holding stocks and shares in various undertakings.

Marconi's.

For months past the statisticians have contended that, on the data available, Marconi ordinary shares should be worth 87s. as a minimum. The imminent advent of an official announcement has led to revival of this prophecy, and the price of Marconi's is 2s. 6d. up, at 86s. 3d. It might be thought that this price permitted small scope for possible further profit if the prediction of 87s. is shown to be approximately correct. Reference was made here last week, however, to the "B" shares in the merger undertaking, of which the Marconi Company should receive 5,850,000 against the 3,150,000 that go to the cable companies. These "B" shares in what is to be known as Cable & Wireless, Ltd., are deemed to represent the equity of the whole business involved in the amalgamation. Unofficial dealings are said to have taken place in them already at 30s. per share, and American demand, according to gossip, is considerable. In the uncertainties that surround these "B" shares lie, partially, the speculative attractions which distinguish Marconis.

The One Pound Shares.

Marconi ordinary shares are of the nominal value of 10s. each, and the price is 86s. 3d. In addition, there are 395,114 ordinary shares of £1 each, which arose out of the conversion rights attached to the debentures. These £1 shares stand at 5⅞. How they will fare in the forthcoming distribution is even yet unknown. The Board's view, made public some time back, is so guarded as to shed no light upon the opinion of the directors in regard to the legal status of the shares. The optimists contend that one share of £1 must be equal to two shares of 10s. each, and that the price of the first should be exactly twice that of the second. The other side argues that 10s. of the £1 will be treated in the same way as the 10s. Marconi share, but that the other moiety is worth 10s. and no more. If the first assertion be correct, Marconi £1 shares, on the basis of 4 5/16 for the 10s. shares, are worth 8¼, as compared with the current market price of 5⅞. On the second basis of assumption, the £1 shares are worth 4 5/16, plus 10s.: that is, 4 13/16. The speculator clearly has, in this conflict of view, what the Stock Exchange calls scope for talent. The onlooker will possibly see in it an ample scope for acrimonious discussion and legal expenses.

Electricity Supply.

Announcement by the County of London Electric Supply Company of the intention to issue new capital, in the shape of ordinary and preference shares, caused 1s. decline in County ordinary to 52s. 6d. The new issue, it is safe to guess, will be made at such price as will ensure a bonus to holders of the existing shares. Chelsea Electricity Supply Company is capitalising £8,989 of free reserves, and applying it to full payment of 8,989 unissued ordinary shares. These latter are to be held on account of the pension fund formed for the

benefit of employés. The Altrincham Electric Supply Company did well last year, its report showing good progress in the total sale of energy, and in net profit. The price of the ordinary stands at 60s., giving a yield of 7 per cent. on the money. The 1s. deferred, now at 17s. 9d., return 8 per cent. The 7 per cent. second preference, of which a 60 per cent. bonus was distributed for 1927 to holders of the ordinary shares, are quoted at 22s. 6d.

Clyde Valley.

Brief mention was made in last week's number (Elec. Rev., p. 622) of the new issue of three ordinary in respect of every four shares held, by the Clyde Valley Electrical Power Company. The price of the shares remains unchanged at 43s. 9d. The Clyde Valley is one of the best in its class. Its earnings of recent years have been materially higher than the amounts distributed in dividends. Sound management has placed the company in a fine financial position, and although the shares, when quoted ex dividend and ex rights, will pay barely 5 per cent. on the money, they can be reasonably expected to increase in value by steady degrees. The yield calculation is worked out on the assumption that the company will maintain, on its increased capital, the 8 per cent. dividend at present being paid.

Tubes and Trams.

Underground Electric Railways income bonds at 112 are a couple of points down, and the shares fell 6d. to 22s. 6d., movements that are difficult to explain in view of the better tendency that has been established during the past few business days amongst Home Railway stocks. There is still some uneasiness felt in regard to the extra cost to which the Underground Electric Railways will be put by reason of the advance in the price of petrol. Probably it is this consideration that holds back the prices of Underground stocks from sharing in the otherwise general recovery. No changes of consequence have occurred amongst the various tramway stocks and shares. Northern General Transports at 1⅜ are quoted ex rights.

New Issues.

One new share at 32s. 6d. is offered in respect of every two old shares held in the Electrical Finance & Securities Co., Ltd. This constitutes a useful bonus, as the old shares stand at 37s. 9d. The company's 7 per cent. preference are 22s. 9d. A free share bonus is offered to proprietors of Shanghai Electric Construction shares, the dividend upon which, for the year recently ended, is raised from 12 per cent., less tax, to 12½ per cent., free of tax. The total capital is to be increased by £200,000, to £700,000. There is not a very free market in the shares, but on the dividend and bonus announcement, the price strengthened to 59s. 6d. Atlas Light and Power shares are quiet at 26s. 9d. The company states that it gave an option, the time expiring this, Monday, evening, at $100 over its holding of 100,000 South American Power preference shares. The option formed part of the arrangement under which the Atlas Light and Power sold its Argentine electrical and tramway holdings to the American and Foreign Power Company of New York.

A market will start, in the near future, in the shares of the Electric Furnace Company, which has a capital of £200,000 divided equally between 100,000 £1 preferred ordinary shares and a similar number of ordinary, the greater part of which has in each case already been issued. The company was incorporated last year to take over the business originally founded 20 years ago by D. F. Campbell and W. S. Gifford.

Dollar Stocks.

Brazilian Tractions, after being up to 63, reacted to 61, a net fall on the week of one point. Mexico Tramway shares went back to 47; Montreal Light and Power are unchanged at 105; Shawinigan is a point lower at 76¼. British Columbia Power shares are dull at 50½ for the "A" and 31 for the "B," while Hydro-Electrics dropped from 37 to 35⅝. International Holdings going back at the same time to 8¼. Mexican Light and Power common shares regained the fall of 4¼ points that they sustained last week, and the 7 per cent. preferred shares at 71½ are up 1.

Miscellaneous Shares.

London Electric Wire Co. & Smiths ordinary shares marked 23s. 6d. on the report, which announces 1928 profits of £110,300, being £14,700 better than those of the preceding twelvemonth. A dividend of 7½ per cent. is again to be paid, and at the present price the yield on the money comes to £6 7s. 8d. per cent. The 7½ per cent. preference shares are quoted at 24s. 3d. Reference is made in the report to the increasingly keen competition in the trade. British Insulated ordinary have regained the small fraction that they lost in the previous week. Enfield Cables rose to 4¼. Other changes amongst the prices of manufacturing companies' shares are negligible. General Electrics hold on to their previous level of 60s. New York has been dealing very slightly in the shares, pending a settlement of the final terms upon which the new issue is to be made. The company denies the rumour of its negotiating with the Associated Electrical Industries. Sphinx Electrics have been active around 1s. 9d., on the contracts secured by the company. The iron and steel group has nothing of fresh interest to show, and rubber shares are dormant.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Approx. Dividend. 1927.	1928.	Price April 8 1929.	Rise or fall	Yie'd p.c.
Bournemouth and Poole	1	15	—	64/6	—	... ...
Brompton Ordinary	1	8½	8½	27/-	—	5 3 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8⅞	8⅞	27/-	—	5 3 8
City of London	1	10	10	32/-xd	—	4 7 6
do. do. 6% Pref.	1	6	6	23/-xd	—	5 4 4
Clyde Valley	1	8	8	43/3	—	3 14 1
County of London	1	7½	10	52/6	—1/-	3 16 4
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	25/-	—	5 12 0
Elec. Supply Corporation	1	11	—	55/-	—	4 0 0
Kensington Ordinary	1	8	8	26/6	—	5 5 8
Lancs. Light and Power	1	7½	—	30/-	—	5 0 0
London Electric	1	8½	9	27/-xd	—	5 3 8
Metropolitan	1	9	9	2½	—	4 7 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	28/-	—	4 12 10
Mid. Elec. Power	1	15	8	36/3	—	4 2 9
Newcastle on-Tyne Ordinary	1	6	6	1½	—	4 16 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	31/-xd	—	5 3 3
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	—	4⅜	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	34/-	—	4 14 2

Home Rails.

Central London Ord. Assented	Stock	4	4	72	—	5 11 1
Metropolitan	,,	3	3½	60½	—	5 15 8
do. District	,,	4	5	76½	—	6 10 9
Underground Electric	£1	5	7	23/6xd	—6d.	5 19 2
do. do. Income	Bonds	6	6	112	—2	5 7 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24	—	6 3 9
Automatic Telephone	1	10	12½	2⅞	—	5 14 2
Eastern Extension	10	10	10	28¼	+1½	*3 11 0
Eastern Tel. Ord.	Stock	10	10	280	+12½	*3 11 5
Globe Tel. and T. Ord.	10	10	10	27½	+1	*3 12 9
do. do. Pref.	10	6	6	11½	—	5 9 0
Great Northern Tel.	10	20	—	32	—	... ...
Indo-European	25	10	10	55½	—	*4 10 0
Marconi	10/-	10	—	4⅞	+⅛	... ...
Marconi-Marine	1	12½	15	8¼	—	4 16 0
Oriental Telephone Ord.	1	12	—	2¾	—⅛	...
Western Telegraph	10	10	10	28½/-	+27/6	3 11 3

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3½	—	7 9 3
do. do. 2nd Pref.	5	6	6	3⅞	+⅛	7 14 10
do. do. 5% Deb.	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	—	850	—	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	61	—1	3 4 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	95½	—	5 1 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	12/-	—	... ...
London United Tram Deb.	Stock	4	4	61	—	6 11 4
Mexico Trams, 5% Bonds	—	5	5	69½	—	7 4 0
Mexican Light Common	100	Nil	Nil	80	+4½	... ...
do. 7% Pref.	100	7	7	75½	+1	9 5 6
do. 1st Bonds	—	5	5	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

		1926,	1927.			
Assoc. Elec. Ord.	1	—	—	38/3	—	... ...
Babcox & Wilcox	1	13	15	3⅞	—	*4 7 3
British Aluminium Ord.	1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref.	1	7	7	15/-	—	9 6 8
British Insulated Ord.	1	15	15	4⅝	+⅛	3 5 6
Brush Ord.	1	10	10	27/6	—	7 5 6
Callenders	1	13	15	4⅜	—	3 9 0
do. 6½% Pref.	1	6½	6½	1⅛	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	1	—	... ...
do. 8% Pref.	1	—	8	25/-x d	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	25/9	—	7 1 2
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	1	—	7 10 0
Enfield Cable Ord.	1	20	20	4¼	+⅛	4 17 0
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref.	1	8	Nil	9/6	—	... ...
Gen. Elec. Pref.	1	6½	6¾	24/6	—	5 6 1
do. Ord.	1	7½	10	3	—	3 6 8
Henley	1	25	25	6	—	4 1 8
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	12½	10	1⅛	—	5 8 1
Siemens Ord.	1	7½	7½	1⅜	—	5 9 1
Telegraph Construction	12	10	10	25½	—	*4 14 3

* Dividends paid free of Income Tax.

The Electrical Trade of Holland.

A Comparison of Import and Export Figures for 1927 and 1928.

THE following statement, showing the imports and exports of electrical and similar goods into and from Holland during the year 1928 is compiled from the recently-issued statistics. The figures for 1927 are added for purposes of comparison and notes of any increases or decreases are given:—

Imports.

	Thous. Guilders. 1927.	Thous. Guilders. 1928.	Thous. Guilders. Inc. or dec.
Electric generators, motors, transformers and rotary convertors—			
Total	7,205	8,720	+ 1,515
From Germany	4,148	4,540	+ 392
„ Great Britain ...	959	1,320	+ 361
„ Switzerland	556	800	+ 244
„ Belgium	448	890	+ 442
„ United States ...	195	230	+ 35
„ France	427	440	+ 13
Electric locomotives—			
Total	163*	98	− 65
Wireless apparatus—			
Total	4,817	9,460	+ 4,643
From Germany	2,360	4,180	+ 1,820
„ Great Britain ...	1,078	1,760	+ 682
„ France	444	350	− 94
„ United States ...	348	520	+ 172
Telegraph and telephone apparatus—			
Total	5,579	8,340	+ 2,761
From Germany	3,214	4,740	+ 1,526
„ Belgium	520	1,150	+ 630
„ Sweden	1,166	1,470	+ 304
„ Great Britain ...	226	220	− 6
Other electrical apparatus and instruments—			
Total	7,209	8,270	+ 1,061
From Germany	5,176	5,860	+ 684
„ Sweden	214	200	− 14
„ Great Britain ...	529	870	+ 341
„ United States ...	399	—	− 399
„ Switzerland	567	540	− 27
Steam boilers—			
Total	5,769	6,930	+ 1,161
From Germany	2,310	2,270	− 40
„ Great Britain ...	2,011	2,650	+ 639
„ Belgium	524	580	+ 56
„ France	528	1,050	+ 522
Electric cable, insulated—			
Total	9,902	7,840	− 2,062
From Germany	8,221	6,353	− 1,868
„ Belgium	911	950	+ 39
„ Great Britain ...	353	180	− 173
Steam engines and turbines—			
Total	2,836	3,590	+ 754
From Germany	1,051	1,470	+ 419
„ Great Britain ...	810	1,000	+ 190
„ Belgium	230	350	+ 120
„ Sweden	—	110	+ 110
„ Switzerland	259	400	+ 141

Exports.

Wireless apparatus—			
Total	9,197	22,000	+13,803
To Germany	1,705	2,800	+ 1,095
„ Great Britain	1,346	2,470	+ 1,124
„ Dutch East Indies ...	285	560	+ 275
„ France	1,400	3,300	+ 1,900
„ Sweden	540	1,140	+ 600
„ Argentina	380	1,950	+ 1,570
„ Australia	430	1,840	+ 1,410
Electric generators, motors, transformers and rotary convertors—			
Total	5,305	7,110	+ 1,805
To Germany	1,780	2,050	+ 270
„ Belgium	515	670	+ 155
„ Dutch East Indies ...	739	790	+ 51
„ Spain	322	390	+ 68
„ South Africa	177	†	—
„ Australia	191	390	+ 199
Telegraph and telephone apparatus—			
Total	758	560	− 198
To Great Britain	318	360	+ 42
„ Dutch East Indies ...	†	100	—
„ Germany	120	40	− 80
Other electrical apparatus and instruments—			
Total	2,792	3,170	+ 378
Steam boilers—			
Total	1,630	2,170	+ 540
To Dutch East Indies ...	1,151	1,350	+ 199
„ South Africa	13	†	—
„ Curacao	56	170	+ 114
Insulated copper wire and cable—			
Total	3,438	4,111	+ 673
Metal filament lamps—			
Total	19,451	23,900	+ 4,449
To Belgium	963	1,600	+ 637
„ Great Britain	1,853	1,400	− 453
„ France	2,479	4,300	+ 1,821
„ Italy	2,067	2,650	+ 583
„ Spain	263	160	− 103
„ Argentina	1,402	2,560	+ 1,158
„ Brazil	865	750	− 115
„ Australia	1,692	1,600	− 92
„ Dutch East Indies ...	785	1,200	+ 415
Steam engines and turbines—			
Total	2,037	2,100	+ 63
To Germany	90	120	+ 30
„ Belgium	143	80	− 63
„ Dutch East Indies ...	1,103	1,200	+ 97
„ Italy	225	140	− 85

(Florin or Guilder=about 1s. 8d.)

* Mainly from Germany.

† Not separately distinguished.

It will be seen that while Holland's exports of power plant have increased substantially, they are still below the level of imports, as the latter again show a considerable advance. From being in 1926 an importer of radio apparatus to a slightly larger extent than an exporter, Holland last year exported such apparatus to the value of nearly 23,000,000, while importing less than 9,460,000 guilders' worth. Of other telephone and telegraph apparatus, as well as electric cable, Holland, however, still imports more than she exports.

Conditions in the Netherlands East Indies.

Advice to British Manufacturers.

THE British Commercial Agent at Batavia (Mr. H. A. N. Bluett) has prepared for the Department of Overseas Trade a report on economic conditions in the Netherlands East Indies. (Stationery Office, 3s. net.) The report is prefaced by a few facts regarding the islands. The population is nearly 50 millions, of which 35 millions live in Java and Madura, whose area is only about 7 per cent. of the total area of the territory. While the official language is Dutch, English and German are extensively used in commercial correspondence. Great Britain is the second largest supplier to the Netherlands East Indies and fourth in the list of customers, Holland, of course, being first in both directions.

In his introduction Mr. Bluett says that the hopes entertained for a return of exceptional prosperity in the period under review were not entirely fulfilled. The main reason for this is that the reduction of the purchasing power of the Western nations has prevented them from keeping pace with the producing power of Eastern countries, with a consequent decline in prices. In some cases this decline has adversely affected the public revenue.

Import Trade.

Mr. Bluett says that the 1929 import prospects appear favourable. It may be anticipated that a steady demand will rule for the specialised machinery required by estates, and also

for hydro-electric plant, gas engines, oil engines, transformers, dynamos, and motors. In the last year or so there has been an exceptionally good demand for electrical machinery, but, states the author, in this line the United Kingdom is not getting so large a share of the trade as the excellence of British manufacture and our present competitive prices call for. Imports are principally from Germany, Holland, and Switzerland, while sales are effected locally through the branch offices in Java of the leading Continental manufacturers. British manufacturers have preferred to appoint as their representatives locally-established Dutch firms whose multiple interests preclude them from concentrating on the sale of any particular line. It is thought that a far greater share of the valuable orders for electrical equipment which may be expected within the next two or three years would be obtained by the United Kingdom if manufacturers would only strengthen their selling organisation in the territory, either by attaching salesmen to their existing agents or by establishing their own selling organisations in Bandoeng or Sourabaya. There is a demand for insulated copper wire, but British suppliers have been unable to compete with Holland, Germany and Japan. The reverse is the case in copper tubes and fittings, of which over half were supplied by United Kingdom manufacturers.

Railways and Communications.

The report states that although a sum of 10,288,000 florins is being spent during 1929 on improvements and minor extensions to the existing State railways in Java, and 6,334,800 fl. on new construction, only 279,000 fl. (as against 1,131,200 fl. in 1928) is allotted for electrification. This sum is intended for the completion of work already in hand. The present programme will come to an end with the completion of the Batavia complex and the electrification of the Manggarai-Buitenzorg line. Sufficient locomotives, rolling stock and accessories have already been purchased. The cost of the Manggarai-Buitenzorg electrification is expected to reach about 12 million florins, which is about 2 millions less than the original estimate.

Considerable development has taken place in radio-telegraphy, and there is now direct communication with Holland, Germany, France, the United States, French Indo-China and Manila. Greater efficiency has been attained by a more extensive application of the short-wave system and automatic reception. Experiments with radio-telephony have been made, and although considerable difficulties have still to be overcome, it may be expected that the Post and Telegraph Service will shortly inaugurate a public service. So far, no progress has been made in the formation of a local broadcasting company, though it may be anticipated that a concession for radio broadcasting will be granted soon.

The following statistics of the imports of Java and Madura cover the bulk of the trade of the Netherlands East Indies.

Electrical Imports of Java and Madura.

THE statement is based on the recently-issued official statistics, and shows the values of the imports of electrical and allied material into Java and Madura during 1927. The figures for 1926 have been added for purposes of comparison and notes of increases or decreases given. Holland supplies the greater proportion of the Government's requirements, but Great Britain has a small share of the import trade on private account. The guilder is worth about 1s. 8d.

	1926. Thous. Guilders.	1927. Thous. Guilders.	Inc. or dec.
Electric lamps, incandescent—			
Total	868	1,030	+162
From Holland	704	810	+106
,, Germany	122	130	+ 8
Insulators (private)	70	110	+ 40
Do. (Government)	110	70	- 40
Uninsulated and insulated electric wire—			
(*a*) of aluminium—			
Total (private) all from Great Britain in 1926 and U.S.A. in 1927	92	160	+ 68
(*b*) of iron—			
Total (private)	33	50	+ 17
Total (Government)	46	90	+ 44
(*c*) of copper—			
Total (private)	1,050	1,390	+340
From Holland	351	440	+ 89
,, Great Britain	5	7	+ 2
,, Germany	346	530	+184
,, Japan	279	180	- 99
Total (Government)	301	450	+149
From Holland	267	360	+ 93
,, Germany	28	70	+ 42
Electric cables—			
Total (private)	704	1,020	+316
From Holland	321	280	- 41
,, Great Britain	—	1	+ 1
,, Germany	332	570	+238
,, Japan	9	40	+ 31
Total (Government)	120	310	+190
From Holland	115	100	- 15
Materials for overhead transmission lines—			
Total (private)	330	670	+340
From Germany	*	430	—
,, United States	*	8	—
,, Holland	*	205	—
Total (Government)	440	370	- 70
From Holland	*	210	—
,, Germany	*	160	—
Materials for electrical installations in buildings—			
Total (private)	466	670	+204
From Germany	369	520	+151
Batteries—			
Total (private)	119	180	+ 61
From Germany	25	18	- 7
,, Denmark	20	16	- 4
,, United States	27	100	+ 73
,, Japan	27	20	- 7
Total (Government)	76	60	- 16
House lighting and small power sets—			
Total (private)	8	10	+ 2
Do. (Government)	2	4	+ 2
Accumulators—			
Total (private)	202	380	+178
From Great Britain	32	60	+ 28
,, Germany	50	120	+ 70
,, United States	89	180	+ 91
Total (Government), nearly all from Holland	340	630	+290
Wireless installations and apparatus—			
Total (private)	357	500	+143
From Holland	171	260	+ 89
,, Great Britain	33	70	+ 37
,, Germany	130	130	—
Total (Government)	326	550	+224
From Holland	233	410	+177
,, Germany	53	100	+ 47
,, Great Britain	21	*	—
Telegraph and telephone apparatus, &c.—			
Total (Government)	58	190	+132
Total (private)	63	100	+ 37
From Germany	35	44	+ 9
,, Great Britain	12	25	+ 13
Electrical installations and apparatus, unspecified—			
Total (private)	394	1,060	+666
From Germany	269	850	+581
,, Holland	81	150	+ 69
,, Switzerland	16	20	+ 4
Total (Government)	139	190	+ 51
From Holland	103	*	—
,, Germany	—	130	+130
Electric fans and ventilators—			
Total (private)	105	104	- 1
From Holland	11	10	- 1
,, Germany	57	42	- 15
,, United States	27	40	+ 13
Dynamos, motors, transformers and rotary convertors, not elsewhere specified—			
Total (private)	1,113	1,200	+ 87
From Holland	247	390	+143
,, Great Britain	38	30	- 8
,, Germany	543	1,140	+597
,, United States	225	70	-155
,, Switzerland	—	280	+280
Total (Government)	171	250	+ 79
From Holland	83	120	+ 37
,, United States	76	—	- 76
,, Germany	—	120	+120
Automobile dynamos—			
Total (private)	29	26	- 3
Parts of dynamos, electric motors, transformers and rotary convertors—			
Total (Government)	19	50	+ 31
Total (private)	152	230	+ 78
From Germany	96	140	+ 44
,, Holland	30	60	+ 30
,, United States	10	6	- 4
,, Great Britain	10	6	- 4

* Not specified.

A Large Metal-clad Switch Unit.

Messrs. Ferguson, Pailin, Ltd., announce another development of their well-known line of metal-clad switchgear which embodies the vertical isolation principle.

DESIGNED to meet the demand for a switch of 750,000 kVA rupturing capacity that can be accommodated in small space, the gear illustrated below affords at the same time safe accessibility to all parts. The ranges are from 900 amperes at 33,000 volts to 4,000 amperes at 11,000 volts, and the duplicate bus-bar unit incorporates the breaker transfer method of bus-bar selection, which arrangement is quicker and more positive than plug changing. With this scheme, to effect bus-bar transfer the circuit breaker is lowered by the motor operating gear, moved horizontally along its supporting carriage, and then motor-raised to the operating position on the other set of bus-bars.

The gear is built on the unit principle: on duplicate bus-bar systems this enables additional units to be added without shutting the gear down; furthermore, it is jig assembled, so that similar parts are strictly interchangeable. The supporting structure consists of a welded-steel pipe framework, mounted on cast-metal bases. Separate earthed metal chambers are provided for each set of bus-bars, for the current and protective transformers, for the voltage transformer, and for the cable terminal arrangements. They are cast in non-magnetic material for the heavier currents.

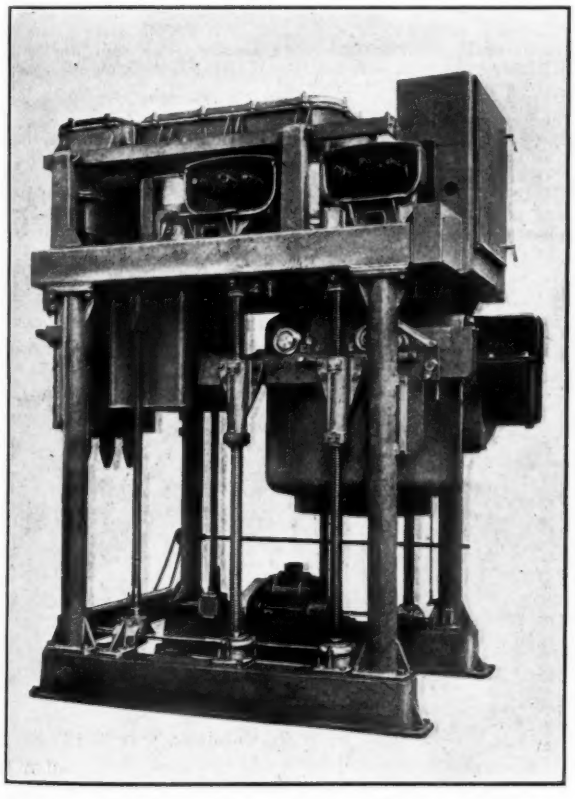


Fig. 1.—Side-front View of Solenoid-operated Unit.

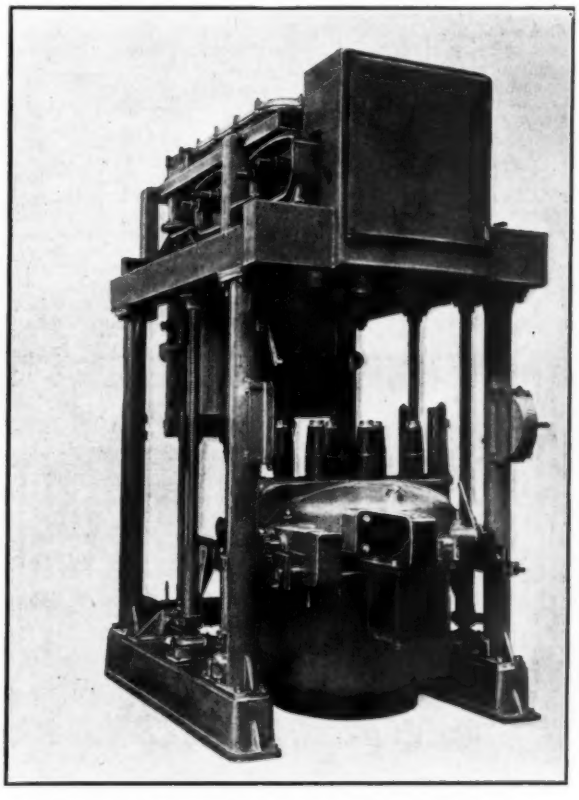


Fig. 2.—Circuit Breaker in Transfer Position.

The bus-bars are insulated with bakelite bushings and run in solid with compound, whilst the current and protective transformers may be solid compound filled, or immersed in a fluid compound, which makes them accessible for changing for others of different ratio or capacity; the voltage transformer is oil immersed. The cable-terminal chamber is normally arranged to be filled solid with compound, universal type glands being fitted. Special high-pressure chambers can be provided for oil- or fluid compound-filled cables, and expansion boxes are fitted on all compound-filled chambers. The insulation consists of bakelite throughout, condenser bushings being employed for the higher voltages.

The bus-bars and connections consist of copper rod, tube or strip, according to the current and voltage ratings. The secondary connections are rubber-insulated stranded copper conductors, with fire-proof braiding overall, enclosed as far as possible in solid-drawn steel conduit with bushed ends, having inspection elbows where necessary. A valuable feature is the pressed-steel wiring box in which the multi-core cables from the control panel terminate; the terminal boards are fitted with disconnecting links to facilitate testing. In the case of solenoid-operated circuit breakers, ironclad closing contactors are mounted in the box, to which access is readily obtained by means of a pressed-steel swing door.

The movement of the circuit breaker for isolation, inspection of contacts, removal of tank, or for complete removal of the breaker, is downwards by means of motor-operated worm gearing and substantial screws mounted in pairs on each side of the unit. These screws are traversed by nuts to which the supporting carriage is bolted; the operations are controlled by an ironclad switch from the front. The socket members of the isolating features form an integral part of the circuit breaker bushings, and are of the self-aligning type. An effective disconnecting device for heavy currents, which permits easy insertion and withdrawal of the breaker, yet ensures high contact pressure when in operation, has been patented by Messrs. Ferguson, Pailin, Ltd. All operations are mistake proof, a full, yet simple, system of interlocks being incorporated.

The circuit breaker is characterised by its massive construction, single-cylindrical welded-steel tank with dished bottom, high domed steel top-plate ensuring an ample air cushion, internal link mechanism, high-pressure oil gauge, and pebble-filled gas vents, which are automatically connected to the exhaust chambers on the fixed portion of the gear when the breaker is inserted. The exhaust gases may be led away as desired. The operating gear is of the patented mechanically trip free type, and is of a simple design which eliminates complicated link gear; it can be arranged for solenoid or motor operation, and means are provided for emergency manual operation. A truck with roller-bearing wheels is supplied with an initial installation to facilitate removal of the breaker or tank.

Both current and protective transformers are located on the feeder side of the circuit breaker, and on account of the heavy short-circuit currents which might be developed, they are of the single-turn-primary pattern. A patented self-compensating

current transformer is provided when a low ratio is required, and additional secondary windings, or double-ratio transformers, can be supplied. The voltage transformer is mounted (complete with its resistances and fuses) in an oil-filled chamber which is fitted with a breathing device. Independent isolation is provided to enable inspection, or repairs, to be carried out whilst the unit is in commission. The fixed contacts are screened with metal safety covers when the transformer is withdrawn. Simple mechanical interlocks prevent insertion or withdrawal of the transformer, unless it is completely enclosed. The chamber will accommodate three single-phase transformers, or a 3-phase transformer with an additional winding for the operation of an automatic voltage regulator.

The design, which complies with the latest B.E.S.A. requirements, enables the company's well-known duplicate circuit breaker method of bus-bar selection to be installed at a later date, if desired, in place of the transfer breaker arrangement.

High-voltage A.C. Generation.

A proposal to partially abolish the use of step-up transformers by the direct generation of alternating current at high pressure.

By SIR C. A. PARSONS, F.R.S., Hon.M.I.E.E., and J. ROSEN, M.I.E.E.

(*Extracts from a paper read before the* Institution of Electrical Engineers.)

THE expression of a wish by an engineer who was responsible for a power supply system (in which the greater part of the energy was transmitted in bulk at 22 kV to a point some distance from the power station, the generating pressure being 11,000 volts) that a reliable generator might be designed capable of generating direct at the higher voltage, led the authors to believe that the problem might be a general one; it came at a time (in 1921) when their thoughts were turning to the design of the largest units which have now materialised, that is, 50,000 and 100,000 kW. With the increasing size of generating unit, the greater were the advantages to be gained in the design of alternators for direct generation at 22 or 33 kV, and in the case of large sets at the lower voltages, to keep the current per conductor low; conductors in two or more adjacent slots would be connected in parallel, thus presenting difficulties in windng, in order that the resultant voltages of each parallel path should be equal in magnitude and also in phase. The number of conductors in series per phase upon which the designer can ring the changes may be as low as 10 or 12. This restriction may impose such limits on the design that an alternator to meet the specified conditions may differ by as much as 20 per cent. from the most favourable proportions, with consequent lowering of efficiency.

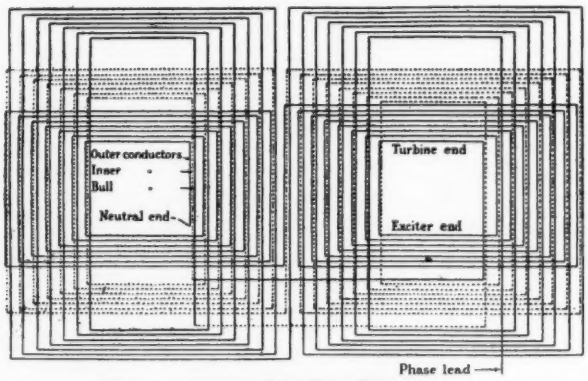


Fig. 1.—Stator Winding Diagram.

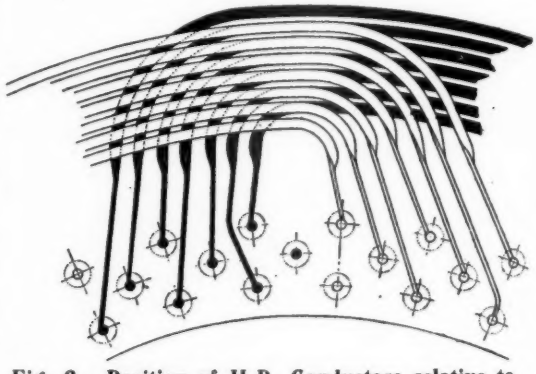


Fig. 2.—Position of H.P. Conductors relative to Adjacent Phases.

On investigation, it was found in many lay-outs that the cost of the leads would be much less and that of the copper bus-bars and switchgear would also be lower; in fact, in the case of the largest sets one switch only would be employed to carry and break the current when two would be necessary at lower voltages.

Considering the cable ducts for an alternator of 94,000 kVA, 11,000 volts, 4,920 amperes, and assuming a density of 820 amperes per sq. in. with lead-covered, paper-insulated, single cables, six cables, each 1 sq. in. in area, would be required for each phase. Assuming that cables are run from the stator earth leads, then there would be a total of 36 cables to be led away from the machine; to suit the requirements of most electrical undertakings, the working density would be lower than that assumed, giving a still greater number of cables. With so many cables grouped together, the maximum output would not be obtained from them.

Most of these difficulties are overcome when an alternator of higher voltage is employed: at 33 kV the current is reduced to 1,640 amperes; against 6 or 7 cables for the lower-voltage machine there are only 2 cables per phase, and they can be loaded up to their full capacity. The leads and sealing ends are readily accommodated in the foundation block, the width of the tunnel being reduced from 14 ft. to 8 ft. 6 in., and the machine placed on a firmer foundation. The sizes of 33-kV cable-sealing bells are only slightly larger than those for 11,000 volts, and cables for the 33-kV machine cost £20 per yard run, and for the 11,000-volt machine £37 per yard run for the above output.

As an example of the necessity for reducing the current in large units, the General Electric Co., of Schenectady, when designing the 208,000-kW unit for the State Line station of the State Line Generating Co., near Hammond, Ind., found it necessary to increase the alternator voltage for this purpose. There are three main units running at 1,800 r.p.m., comprising a high-pressure turbine driving a 76,000-kW alternator (0.85 power factor), and two low-pressure turbines, each driving a 62,000-kW alternator. The main alternators were first designed for a voltage of 18 kV, instead of the standard voltage of 13,400 volts, but it was later found necessary to raise it to 22 kV. The transmission voltages are 33, 66 and 132 kV; it is apparent that the generating voltage has been increased because of the difficulties which arise with the heavy currents.

The authors have been repeatedly reminded that if they can show sound reasons for generating at a higher voltage, then 66 kV (recognised as one of the standard transmission voltages) would be the most advantageous, but there are many conditions under which 22 and 33 kV would be considered economical, more especially when the station is at the centre of, or at only a few miles' distance from, the main centre of consumption of the power, and when underground cables may be employed for transmission; for example, Barton, Clyde Valley, the proposed site at Carrington, and others, all have surrounding areas which can economically consume power at 33 kV, and enable a saving to be made by direct generation and switching at 33 kV.

When the generator can be constructed to supply the transmission system directly, without the intervention of step-up transformers, the whole sum representing the cost of the transformers and their housing and the capitalised value of their losses, less the additional cost of the high-voltage generator, can be saved. Various other items in which there is a direct financial saving may be summarised as under:—

Transformers will usually be 3-phase up to 20,000 or 30,000 kVA, and banks of three single-phase units for larger outputs. Artificial cooling, either by water or air, will be required

above 15,000 kVA, and is included in the prices given below. The figures apply to transformers stepping up the generator voltage to 33 kV. The capitalised value of transformer losses represents a considerable part of the total capital outlay, and is so much greater than the extra cost of the high-voltage generator that the saving of this expenditure is alone sufficient to justify the use of higher generating voltages, when transformers can be eliminated.

The cost of switchgear may become excessively high for very large sets at low voltage; the cost of maintenance also will be higher for the very heavy gear required for large currents.

Consider a set of 75,000 kW giving its full output at a power factor of 0.8, the equivalent output thus being 94,000 kVA, supplying a network of 33,000 volts, so that a transformer bank will be necessary in the first case; it is assumed that the switchgear is on the 33-kV side. The following comparison can then be made:—

Set:	"A"	"B"
Generator output kVA	94,000	94,000
Generator voltage	11,000	33,000
Approximate additional cost of generator	—	£10,000
Cost of cables (100 yards' run)	£3,675	£2,000
Cost of transformers	£19,000	—
Transformer losses:		
Fixed, kW	250	—
Variable at full load, kW	400	—
Variable at 60 per cent. load factor, kW	144	—
Transformer cooling equipment:		
Input to motors, kW	50	—
Reduction in cost of buildings, &c., and transformer foundations ...	—	£500
Annual cost of fixed losses [at £1 per kW (0.1d. per unit)]	£1,400	—
Annual cost of variable losses ...	£925	—
Capitalised cost of transformer losses at 10 per cent.	£23,250	—

The 33-kV machine thus shows a capital saving of £44,425, from which the extra cost of the former must be deducted, leaving a net saving of £34,400. When the generator voltage is stepped up to 66 kV it might be possible to take advantage of the low step-up ratio and effect a saving by the use of auto-transformers.

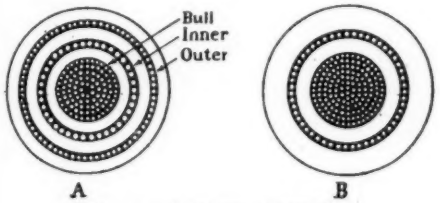


Fig. 3.—Sections through Conductor Bars.

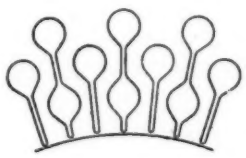


Fig. 4.—Conductor Slots in Three Rows.

	"A"	"B"
Generator voltage	11,000	33,000
Cost of cables (100 yards' run)	£3,675	£2,000
Cost of auto-transformers	£16,000	£9,750
Capitalised value of losses	£20,000	£12,500
Reduction in building costs	—	£1,000
Cost of switchgear	£9,000	£6,200

The total capital saving on the 33,000-volt generator is then £19,225, less £10,000, or a net saving of about £9,000.

The design of the 33,000-volt, 25,000-kW, 3,000-r.p.m. alternator now installed at the Brimsdown power station, North London, is based on a concentric type of core conductor which made it possible to prepare designs with greatly increased phase voltage, without increasing the voltage gradient across the winding insulation. By its use an alternator can be so wound as to distribute the dielectric stress and to lower its mean value at that part of the machine where there is limited area, and the maximum of heat generation at the regions adjacent to the stator bore. In the designs of alternators at voltages of 33 kV and 44 kV between phases, there is sufficient margin to permit insulated conductor bars to be used with thicknesses of insulation not exceeding those of which experience had proved satisfactory.

A section through one conductor bar is illustrated in fig. 3 A; the insulation between conductors is of micanite, and there are three conductors per slot, nested one within the other, the conductors being wound in such a manner that the voltage is gradually stepped down from the innermost conductor. This formation of conductor is also mechanically very strong, a distinct advantage where the conductor projects beyond the stator core, for coupling to the end connections. The "bull" conductors of each phase are connected in series, and are then connected to the surrounding "inner" conductors which are again connected in series and finally connected to the "outer" conductors, which are starred to the ends of corresponding conductors of the remaining two phases, and then connected to earth.

The diagram of connections shown in fig. 1 is for a 3-phase, 2-pole alternator having 90 slots and three conductors per slot. The winding of each phase has 88 conductors distributed between 30 slots, the voltage generated per conductor being 217 V. The phase voltage and the maximum voltage to earth is 19,080 V.

The "bull" conductor potentials range from 19,080 to 13,000 volts, the "inners" from 13,000 to 6,500 volts, and the "outers" from 6,500 volts to zero. There is a substantially constant potential difference of 6,500 volts between the conductors in any one slot, and a maximum voltage from the conductor to earth of 6,500 volts, which are moderate and readily dealt with.

The conductors are arranged in three rows as shown in fig. 4; by staggering the conductor slots the flux density in the stator teeth is kept uniform, and it was found possible to use the round conductor, at the same time obtaining increased internal reactance. It is not necessary to bend the core conductors where they project from the stator, in order to provide a reasonable leakage gap between the end windings and the rotor end-caps. The staggering gives a uniform distribution of winding and, in effect, has the advantages of the smooth-core armature, without the disadvantages of an unduly increased air-gap; the excitation energy is therefore retained at a very reasonable figure.

The "bull" conductor was made in the same manner as an ordinary cable, and varnish-impregnated *in vacuo*, cut into the requisite lengths, and alternate layers of mica and insulated copper strands were applied; after the application of every thickness of insulation the conductors were re-impregnated *in vacuo*. In no part of the manufacture were the conductors in any way bent.

From fig. 2 it is seen that two slots per phase contain only two conductors, instead of three; a detail of the conductor is shown at B in fig. 3. The conductors of the highest potential are not carried to the slots adjacent to another phase; this increases the distance between regions of maximum potential, and reduces to 28,000 volts the pressure between adjacent conductors projecting from the core.

Dr. S. L. Pearce, in his paper on "Prospective Development in the Generation of Electricity and its Influence on the Design of Station Plant," read before the Engineering Conference of the Institution of Civil Engineers in June 1928, says: "In the absence of step-up transformers, or external reactance coils, the reactance required for limiting the short-circuit currents to values within the rupturing capacity of the switchgear has necessarily to be incorporated in the stator windings, with the natural consequence that under short-circuit conditions, the mechanical forces on inherently weaker windings are appreciably increased." In the authors' experience, this difficulty has not arisen. The short-circuit tests carried out on the machine described above proved that the windings are equally as robust as those of a low-voltage machine.

Since the plant was installed in August, 1928, it has operated continuously up to its maximum load at voltages varying between 34,000 V and 35,000 V, and it has withstood without any sign of distress the most severe faults on the large overhead and underground network to which it is coupled. The control and regulation have proved eminently satisfactory in every way. It certainly seems in the natural course of design that a reliable high-voltage alternator is essential to the rapid increase in size of power systems and their interconnections. Other units of ever-increasing size, such as motors, motor-generators, synchronous condensers, &c., may be economically designed and coupled direct to the network without the use of transformers.

The authors hope that they have shown that a definite advance has been made in the generation of electricity and in the design of large generators which may be used for connection to the "grid."

Electrical Manufacturing in Canada.

The merger of three large firms engaged in the manufacture of electrical appliances is being arranged under the name of the Amalgamated Electric Corporation Ltd., with a capitalisation of $3,000,000. The firms included in the merger are W. H. Banfield & Sons, Toronto; the Benjamin Electric Co., the Toronto branch of a Chicago firm, and the Duncan Electrical Co., Ltd., Montreal. Messrs. W. H. Banfield & Sons, established in Toronto in 1878, have taken a leading position in the manufacturing of switch and outlet boxes, wiring devices, and equipment for commercial and domestic lighting. The Benjamin Electric Co. is well known for the manufacture of switchboards and panel boxes, and the Duncan Electrical Co. produces electrical porcelain goods. Mr. W. H. Banfield will be president of the new corporation, the headquarters of which will be in Montreal.

Messrs. Ferranti, Ltd., are to establish a branch at Mount Denis, a suburb of Toronto. A modern plant costing approximately $250,000 will be erected, and 200 men will be employed. The principal lines of manufacture will be radio equipment, meters, and transformers.

H.F. Alternator Developments.

A Description of a Novel Type of High-frequency Inductor Alternator made on the Continent.

At one time alternators of comparatively high frequency were largely used for operating radio spark transmitters. When the latter were replaced by valves high-voltage d.c. generators took the place of the high-frequency alternators in most cases, although alternators (used in connection with high-pressure transformers and valve rectifiers) are still preferred for long-wave transmitters and transmitters of large power. Recently a new field of usefulness for the high-frequency alternator has been developed in connection with induction furnaces, and for this purpose machines of from 350 kW to 2 kW, at frequencies from 500 up to 10,000, are now in regular demand. Such furnaces form inductive loads of low power factor, so that compensation by means of condensers is adopted, and the condensers become smaller and generally cheaper as the frequency increases.

Another use for medium- and high-frequency alternators is for driving high-speed machinery, such as wood-working machinery, by means of 3-phase induction motors. Thus, with a 500-cycle supply a 2-pole induction motor runs at almost 30,000 r.p.m., and can be conveniently coupled directly to the high-speed machine without troublesome gearing. For submarine sound-transmission schemes, again, high-frequency currents up to 8,000 cycles per second are required. Amongst the many other uses for h.f. alternators are the operation of fatigue-testing machines (in which rapidly reversing stresses are applied to the material under test), the production of ozone and other more recent electro-chemical applications, the routine testing of telephone repeating stations, a.c. bridge tests, and so on.

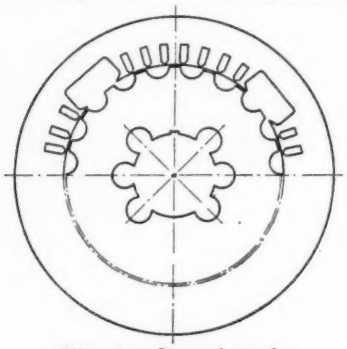


Fig. 1.—Stampings for 100-kW, 500-cycle Alternator.

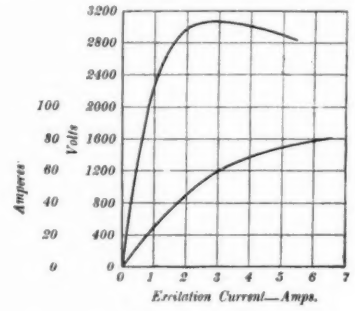


Fig. 2.—No-load and Short-circuit Characteristics.

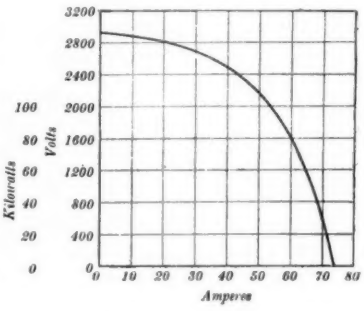


Fig. 3.—Non-inductive Load Characteristc.

In a recent issue of the *E.T.Z.* is described the construction and performance of a somewhat novel type of high-frequency inductor alternator, the "S" type," for which the following advantages are claimed as regards efficiency, size, and cost when compared with the types hitherto used.

The "S type" (1) lends itself to construction in the standard induction motor frame, (2) has a higher efficiency because the whole magnetic circuit is laminated instead of being partly of solid iron as in the ordinary inductor alternator, so that certain additional iron losses are avoided, (3) the cost of winding is reduced, as only a single stator has to be wound, instead of two, and (4) it can be made into a self-exciting alternator by simply placing an ordinary direct-current armature winding in the rotor—in fact, such a direct-current winding can be made to deliver a second output almost as large as that of the main alternator. These double-current generators then develop about twice as much power as any other form of generator of equal size, and have been used successfully in cases where minimum dimensions and weight are essential, such as for aircraft generators.

Fig. 1 shows the stator and rotor stampings of a 100-kW, 500-cycle, 1,500-r.p.m. "S-type" alternator built by the C. Lorenz A.G., of Berlin, for operating a brass-melting induction furnace. As this furnace is worked day and night an exceptionally high efficiency is desired. The generator output is 1,800 volts and 55.6 amperes. It is driven direct by a 3-phase induction motor, and the combined efficiency of the two reached the high value of 84 per cent. The dimensions of the rotor are 498 mm. (19.6 inches) diameter and 420 mm. (16.6 inches) axial width of iron, and a comparison shows that the output obtained is only about 25 per cent. less than that of a standard 50-cycle induction motor of the same size, whilst a standard 50-cycle alternator would have larger dimensions than the "S type" 500-cycle machine.

As can be seen from fig. 1, the machine has four main magnetic poles. Each pole has a d.c. exciting winding of 550 turns of .049 in. diameter wire placed in the large slots shown in the stator. Each pole face has seven slots carrying the main a.c. winding. This winding consists of eight coils per pole of 10 turns each, *i.e.*, each slot contains 20 conductors of copper strip .11 inch by .22 inch. The exciting winding has a resistance of 72 ohms and is loaded at approximately 4½ amperes at 350 volts. The a.c. winding resistance is .88 ohm.

The stator and rotor stampings are made of transformer sheet .013 inch thick. The frame of the machine is similar to that of an ordinary induction motor. As can be seen from the curves reproduced in fig. 2 (no-load and short-circuit currents) and fig. 3 (non-inductive load characteristic), the short-circuit current is not very much greater than the full

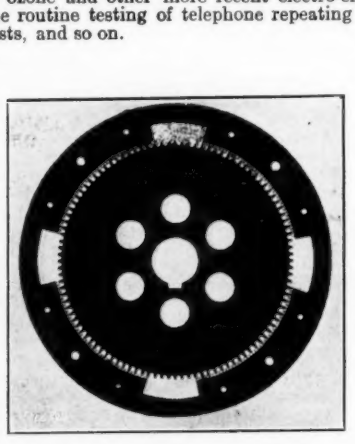


Fig. 4.—Stamping of 2-kW, 8,000-cycle Machine.

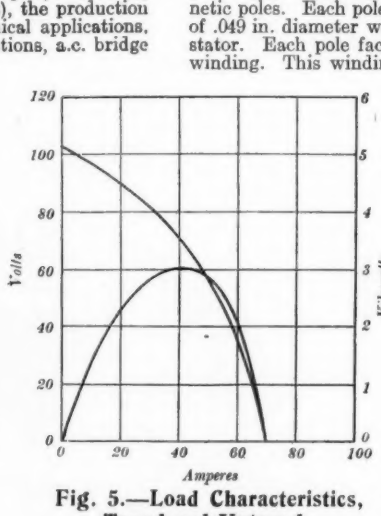


Fig. 5.—Load Characteristics, Tuned and Untuned.

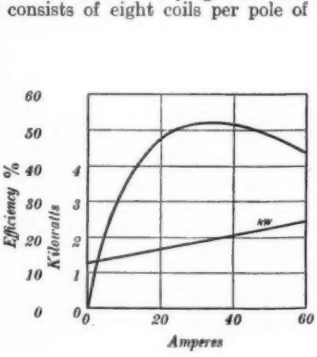


Fig. 6.—Efficiency Characteristic of Combined Machine.

load current. This is characteristic of these high-frequency generators and makes them perfectly safe against short circuits. Thus in this case the full-load current is 55.6 A at 1,800 volts, with an exciting current of 4½ A, and the short-circuit current at this same excitation is only 72 A, or 25 per cent. greater, and the machine could safely run at this larger current continuously. The temperature rise after a continuous run at full load was 42 deg. C.

The following table gives some efficiency readings taken on the set:—

Motor input, kW.	Alternator exciting current.	Alternator output. Volts.	Amps.	kW.	Combined efficiency.
59.6	1.5	1,425	34	48.5	81.3%
109.8	3	1,810	51	92.5	84.3%
125.3	4	2,400	41.5	100	79.8%
112	3.05	1,850	49	90.6	81%
126.3	4.05	1,875	55	103	81.6%
132.5	4.75	1,850	57.5	106	80.4%

If the machine is run on a leading power factor load, as is generally the case, the maximum output increases decidedly and an overload of 25 per cent. can be developed continously.

The "S type" of alternator is especially suitable when still higher frequencies are required and enables smaller and cheaper machines to be produced than does any other form of construction. The following particulars concern a 2-kW, 8,000-cycle alternator. The machine runs at 4,500 r.p.m., and has a rotor diameter of only 9 inches. Fig. 4 shows the shape of the stampings used. The rotor has 108 teeth, and the stator has a tooth pitch of .132 inch. The slots are round and .087 inch in diameter, and each carries a single copper conductor .059 inch in diameter. The normal output is 36 A at 55 volts, so that the current density in the copper conductors reaches the high value of 13,000 A per square inch. This is permissible because, in spite of it, the total copper losses are low (the resistance of the whole winding is only .15 ohm and the loss, therefore, only 195 watts). In fact, the copper loss might safely be trebled in this machine, which means that the density used might be almost doubled.

Fig. 5 shows the load characteristic curves of this machine, both on ordinary "dead" load (untuned) and on a tuned circuit. In this case the machine was run at 5,500 r.p.m. On "dead" load the maximum output is 3 kW, whilst when the circuit is tuned to resonance a maximum load of 5 kW can be obtained.

Fig. 6 shows the combined efficiency curve of the machine and its d.c. motor at 4,440 r.p.m. The efficiency at 2 kW will be seen to be 52 per cent., the alternator itself having an efficiency of 74 per cent. at this output.

As stated above, this form of machine lends itself readily to the addition of a direct-current armature winding and commutator to the rotor, and it can then be used as a very efficient rotary transformer, taking its input from a d.c. supply and delivering a high-frequency output. Many such machines are in use supplying spark transmitters, &c. Efficiencies of as much as 60-65 per cent. can be reached with outputs as small as 300 watts, whilst 1½-kW sizes reach 80 per cent. An additional advantage is the fact that the speed keeps practically constant from no load to full load, owing to the increasing armature reaction of the alternating current as the load increases.

Small machines of this type are also in demand for a.c. bridge tests of all kinds, the outputs varying from 1 to 50 watts. For this work very exact constancy of frequency (± .01 per cent.) is required, and the writer of the article has developed a speed regulator which meets such requirements, even with supply voltage variations of as much as 30 per cent. The other chief requirement is a true sinusoidal curve shape. This can be attained in one of two ways: either a comparatively large machine with a large air-gap and specially shaped pole pieces can be built, or a standard machine can be employed fitted with suitable resonant filter circuits. The latter is found to be the more satisfactory solution, and is also decidedly cheaper.

Sometimes these testing machines are required to give several outputs at different high frequencies at the same time, and for this purpose the "S type" can be very conveniently built with a number of distinct sets of alternator stampings in one frame, all excited by the same set of magnet coils. As many as 10 different frequencies have been obtained from a single machine in this way.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A New Flexible Cable.

We have received from the Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10, a sample piece of "Saxovac," a special flexible cord which the company has produced for use with portable electrical appliances, particularly vacuum cleaners. The cable is of the tough-rubber-sheathed type, with additional protection and finish by means of taping and braiding overall. The standard type is twin 23/36 s.w.g., circular, with twisted v.i.r.-insulated cores, but larger sizes can be supplied, and also cable with a third (earthing) conductor.

An Electric Paper-cutting Machine.

The "British" electric paper-cutting or perforating machine, fig. 1, a recent production of Messrs. Guy V. Laycock, Ltd., 12, Cloth Hall Street, Huddersfield, has been specially

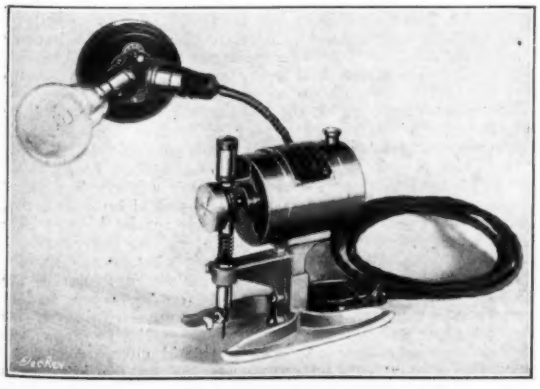


Fig. 1.—"British" Paper-cutting Machine.

designed and constructed for rapidly cutting or perforating intricate designs in wall papers, &c. It will, it is claimed, cut from one to eight or nine thicknesses of paper at once with a loading of about 50 watts. The cutting needle is easily adjusted, and can be replaced at negligible cost. The motor is of the universal type, and is supplied for either 100/120 V or 200/240 V. Ball bearings are fitted, and the only wearing parts are the two carbon brushes. A resistance lamp socket is provided with the machine, enabling the speed of the motor to be set to suit the work in hand, and further, acting as a safety fuse to protect the motor. An 8-c.p., 110-V carbon-filament lamp is usually suitable for 200/240-V machines, but for certain classes of work other sizes can be used with advantage. Provision is made for altering the compression on the spring by raising or lowering the plunger brush. The needle can be raised or lowered, according to the thickness to be cut. The machine is efficiently earthed. The motor drives a reciprocating needle bar through an eccentric mechanism. A steel needle of special shape is clamped in the end of the needle bar, and the reciprocating needle thereby perforates or cuts the paper.

A Self-winding Gramophone.

What is claimed to combine the advantages of both the spring and the electric gramophone motors is the A.E.D. self-winding gramophone, a product of Auto Electric Devices, Ltd., Diamond Works, Brighton, which consists of an electric motor connected to a spring motor of the ordinary standard type through a reduction gear. This is connected to the winding shaft of the spring motor by a coupling consisting of one member fixed to the winding shaft and one sliding member held in engagement by an adjustable coil spring, the actual coupling being effected by two steel balls and sockets. When the spring motor is wound to a pre-determined point at which the tension of the main spring exceeds the tension of the spring which keeps the coupling in engagement, the loose member of the coupling is forced back out of engagement with the fixed member, thus freeing the winding shaft of the spring motor from the electric motor. Attached to this winding shaft at its opposite end is a sprocket wheel, the teeth of which engage with a pivot trigger attached to a steel bar which carries the moving member of the electrical switch. Upon disconnection between the electric motor and the spring motor taking place, the winding shaft of the latter is naturally forced back in a reverse direction by the action of the wound spring. When this occurs, one of the teeth of the sprocket wheel engages with the pivot trigger and moves the switch bar, thus opening the electrical circuit. The pivot trigger is so arranged that in moving it forces a steel pawl into the path of the teeth of the

sprocket wheel, thus checking any further backward movement. Driven from the gear-wheel of the gramophone spring *via* a worm and worm-wheel is a shaft carrying two slotted circular disks. In the slots of these disks is a yielding pin, and according to the time desired between windings, the gear ratio of this member is arranged for the disks to make one complete revolution, on the completion of which the floating pin strikes against a projection on the switch bar, is forced to the other end of the slot, and then drives the switch bar forward, thus closing the circuit and re-starting the winding operation.

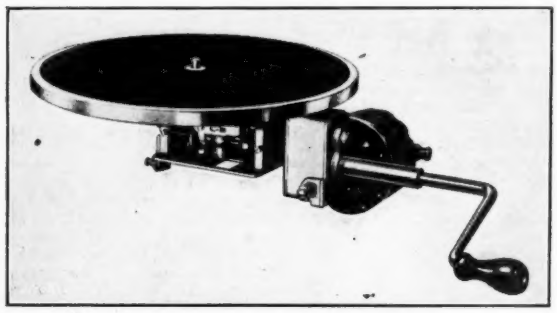


Fig. 2.—A 2.D Self-winding Gramophone Unit.

The apparatus is automatic in action, and therefore can be run indefinitely without any attention at all. Hand winding is provided for emergency use. Fig. 2 shows the motor unit and turntable.

A Large Cable-braiding Machine.

The accompanying illustration, fig. 3, is of a 36-spindle cable-braiding machine produced by Messrs. B. & F. Carter and Co., Lark Works, Hare Street, Rochdale, for covering electric cable up to 3 in. in diameter. It is arranged with a haul-off capstan of 5 ft. diameter, which is sufficiently wide to take three turns of the largest size cable that is to be braided. The machine is fitted with the makers' "Speedway" carriers, which give, it is claimed, a speed of from 20 to 100 per cent. greater than that of the ordinary "weight-and-dropper" type of carrier, and which, being built up practically of steel throughout, are free from breakages. The machine is fitted with machine-cut gearing. Messrs. Carter & Co. have just completed and supplied to one of the large cable companies a machine of exactly the same design as the one illustrated, except that it is arranged for dealing with lead-covered cable up to 5 in. diameter. The

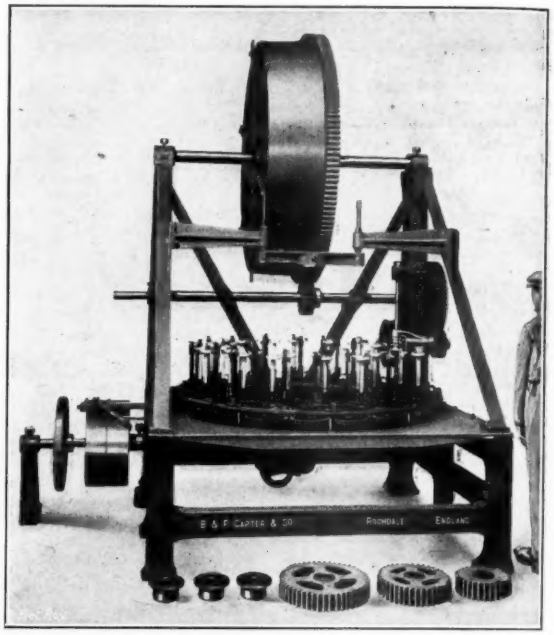


Fig. 3.—Braiding Machine for 3-in. L.C. Cable.

haul-off capstan of this machine is 8 ft. in diameter, which is the smallest diameter that this size of cable will give to. We understand that the machine is the largest that has been made in this country for the class of work referred to.

Electricity in Agriculture.

The salient features of the application of electricity to all kinds of farming, stockraising, crop production, rural dwellings and small industries.

By W. PHŒNIX, A.M.I.E.E.

(*Extracts from a Paper read before the* Western Centre *of the* Institution of Electrical Engineers.)

THE paper is divided into two sections: in Part 1 the condition of the agricultural industry is considered, and it is concluded that its present depression is mainly due to (*a*) cost of labour, and (*b*) reduced area of arable land and stationary yields of crops per acre. It is suggested that an increased application of electricity to agriculture supplies a means of correcting the depression, an increased application of machinery being required to obtain the maximum output per head of labour, whilst electroculture affords a means of increasing crop yields per acre of land. Perhaps the most important function of a rural electricity supply will be to break down the inherent isolation of rural life, which to-day is still crude and not conducive to intellectual advancement.

Up to the present time the lead in development is held in Cheshire, by the Chester Corporation and the Mid-Cheshire Electric Supply Co. Progress has, of course, been made in other counties, but not to the same extent: the Chester Corporation alone has authority to deal with about 140 square miles of rural area. The first Special Order which was granted included only 60 square miles, but after three years of working (during which time 1,152 consumers, including 90 farms, had been connected, and the results had evidently satisfied the Corporation) the area was increased by a second Special Order.

In view of the statement that the new e.h.p. lines of the Central Electricity Board cannot be tapped at a cost of less than £40,000, it follows that the immediate future development of rural electricity supply still depends on the enterprise and efforts of existing supply authorities, who must extend their lines to embrace surrounding districts, gradually penetrating further into the country and so preparing the nuclei of the larger and more comprehensive schemes of the future.

Under the term "agriculture" the whole rural area, its dwellings and small industries, as well as its farms, should be considered. It is to be hoped that the absence of his rival the gas engineer will not cause the electrical engineer to reduce his endeavours, for he will have another competitor, namely, oil, though probably the greatest difficulty he will be called upon to overcome will be that of poverty. Whatever he attempts must be a definite economic proposition, both for himself and his client, and every effort should be made to keep the initial expenditure as low as possible.

The recent easement of the regulations for overhead lines will do much to assist those who are endeavouring to cheapen rural distribution. Underground distribution is to be preferred, and it is regrettable that recourse to overhead lines should be necessary. Every achievable method of cheapening underground distribution should be considered. Much can be saved by the use of multiple service boxes where houses are situated in pairs or small blocks, or, alternatively, there are several excellent ways of supplying houses *en bloc* by means of eaves cables; also road-reinstatement charges are not heavy in rural districts, as the foot-ways are seldom more than cinder paths. Should underground cables, in the face of these possibilities, still prove too costly, overhead distribution becomes inevitable, but it should never be adopted when the former can be employed. When overhead lines are erected the æsthetic aspect should not be allowed to escape attention. The engineer who disfigures the countryside will prejudice the progress of electrification, and the fact that work of an unsightly nature had been done before people had realised the ultimate picture is no excuse for the perpetration of further atrocities "not quite so bad." Still with the æsthetic aspect in mind, efforts should be made to eliminate outdoor substations in rural centres. Small brick buildings

are more in keeping with the amenities of such districts. Such a substation, of a capacity of 100 kVA and arranged for underground e.h.p. loop cables and three or four l.p. distributors, can be erected at a works cost of less than £50, which amount is easily recovered in the difference between the cost of indoor and outdoor equipment. The result is undeniably a better job, whilst maintenance costs are reduced.

The versatility of the engineer will see him over the difficulties of rural work, but it is not intended to imply that special study is unnecessary. The engineer who hopes to progress in rural electrification must equip himself with a general knowledge of agricultural matters and a certain detailed knowledge of cultivation, whilst a knowledge of the economics of agriculture and an appreciation of the depression existing in the industry will be an advantage. Engineers should show that they have courage in their convictions and should not expect too much from the early stages of the supply. The rural load will be very similar in nature to the urban load, a large proportion, whether in the village or on the farm, being domestic; particularly will this be so at the commencement. The process of education will follow the old course *via* the electric lamp. Specialists will become necessary as developments occur; the authority which hopes to continue with the combined distribution engineer, consumers' engineer, salesman and demonstrator, &c., will soon find itself at a disadvantage and will fail to make the progress which it ought to make. Whoever undertakes the supply of electricity to farmers must be able to see through the eyes of an agriculturist.

Efforts should be made to secure the public lighting service, which constitutes an excellent form of propaganda. If secured before the supply is commenced, the use of cable having an extra core (in the case of overhead distribution, an extra line) will be cheaper than installing separate time-switches.

The system of tariffs applicable to other industries will apply equally well to agriculture. Owing to the diversity of applications of electricity and the long working hours, the farm load-factor compares quite favourably with, and in many instances is better than, that obtained with various other industries. Likewise, there is obviously no difference between the characteristics of rural and urban domestic loads, and rural consumers should be given the benefit of any optional tariffs, such as may exist for night loads or water-heating.

An excellent solution to the tariff problem is to apply exactly the same tariffs in rural areas as are in use in the adjacent towns, but with a certain percentage increase, the actual amount depending on the capital expenditure involved in supplying each district. If the increase is carefully chosen for given load conditions, it will encourage development to advertise the possible reductions after stated load conditions have been obtained. Provided care has been taken in fixing the conditions, it should be possible to effect the first reduction after 1 year of supply, or at the most 2 years, whilst after 5 or 6 years the tariffs will become stabilised at a value a little above those in operation nearer to the power station. The difficulty in this scheme is that any increase in load which necessitates alterations to the transmission lines, or substations, may at the same time bring about the need for a revision of the tariff conditions, unless the stabilised tariff has previously been reached. This point should be made clear at the commencement of supply.

In Part 2 electro-culture is classified under (*a*) air-earth currents, (*b*) earth currents, (*c*) seed treatment, and (*d*) other methods. Air-earth current, or the discharge method, is dealt with in detail and empirical rules for its application are given; experiments with an alternating-current discharge are described, and it is suggested that the simplicity of this system and the success of the experiments justifies further investigation on a larger scale. Other systems of electro-culture are dealt with more briefly, emphasis being placed on the value of a successful seed-treatment process. For the electricity supply industry electro-culture will provide excellent propaganda, whilst meeting an urgent need in agriculture.

An over-optimistic opinion of the merits of electro-culture may lead to ultimate disappointment, but a pessimistic view would be equally absurd. It can be stated quite definitely that electrification is effective in increasing crop yields, and further development of the various systems will demonstrate their respective values and afford means of comparing electro-culture with other methods of intensifying crop yields, as, for example, by applying an extra dressing of fertiliser. This aspect of the case is likely to be accentuated in the future, owing to the large quantities of cheap synthetic nitrogenous fertilisers which will be marketed by Imperial Chemical Industries, Ltd.

The nature of agricultural experiments is such that results can only be expected after long and patient effort, and Prof. V. H. Blackman, assisted by others, has undertaken a lengthy task, but one which, judging by present progress, must eventually yield to him a conclusive result. If this is favourable it will fall to the lot of electrical engineers to put the best system into practice in the most economic manner. Meanwhile, to those who have the opportunity, the subject affords an interesting study. It is only by a large number of experiments spread over a period of years and carried out on different soils, and wherever possible on a large scale, that full details of the conditions of field practice will be obtained. The importance of the subject cannot be over-estimated, for it is to agriculture that we owe, and must continue to owe, our existence. In addition, electro-culture should make a special appeal to the electrical engineer. In the home country where fields are of comparatively small dimensions, the overhead discharge method is not impossible, and to our cereal-growing Dominions, where vast tracts of land are cultivated, an earth-current system, or successful seed-treatment, would be a boon. In cotton and tobacco plantations lie other fields of application, for it has been shown that both these crops are susceptible to electrical influence.

That the Government has been disposed to grant a subsidy to the sugar-beet industry is evidence of the importance with which it is regarded, and it is probably in the same field that the greatest advantages will accrue from an application of electro-culture. The beet contract for the years 1928-30 is based on a price of £2 6s. per ton for beet having a sugar content of 15¼ per cent.; £2 9s. per ton for beet having 16¼ per cent. sugar; and for each 1 per cent. above 16¼ the price is to be increased by 3s. 4d. per ton. Since it is possible to increase the sugar content in addition to the yield per acre by applying electro-culture to beet, it will be evident that the advantage to be derived from the application is twofold. Table I shows the probable results of electrification; the nominal increase of 20 per cent. in yield per acre has been taken; also the prices quoted are for beet delivered at the factory, hence the additional freight costs should be deducted from the increased revenue quoted.

TABLE I.

Growing conditions.	Beet tons.	Sugar per cent.	Sugar (total) lb.	Revenue £ s. d.
Normal (per acre)	7.6	15¼	2,639	17 9 6
Electrified (per acre)	9.1	16¼	3,363	22 5 11
Increase due to electrification	1.5	1	724	4 16 5

Finally, the author refers those who desire further information on electro-culture to the bibliography in his paper and to the appendix which gives full particulars of the apparatus used in his own experiments and the results obtained therefrom.

From his experiments, the author draws the following conclusions: (*a*) electro-culture is beyond doubt a means of increasing crop yields, and is also effective in shortening the time required by plants to reach maturity; (*b*) a.c. discharge is quite satisfactory in practice; (*c*) wide variations in the general rules for applying a discharge are possible within limits; (*d*) when the rate of discharge is high a daily application of 4 hours only is better than 6 hours; (*e*) electro-culture, though not a panacea for the distress in agriculture, should by no means be neglected when considering "electricity in agriculture."

The farm of Lieut.-Col. C. Lyon is of interest, since it is one of probably only a few farms where the charge for electricity is based on the maximum-demand (kVA) system, and the monthly demand is therefore recorded. The farm, which is described as arable dairy, is situated in Cheshire, on the outskirts of Warrington, and electricity is taken from the supply mains of the Warrington Corporation. The area of the farm is 237¼ imperial acres, of which 91 acres is arable land. An average of 60 head of cattle and from 200 to 300 head of poultry is maintained on the farm. Electricity is used for lighting throughout the farm buildings, the yard and the farm-houses, whilst it supplies power for operating the following machinery:—

TABLE II.

Month.	Maximum demand, kVA.	Consumption, kWh.
September, 1927	28.0	6,785
October, 1927	11.0	427
November, 1927	11.0	163
December, 1927	20.0	359
January, 1928	2.5	273
February, 1928	2.5	132
March, 1928	2.5	155
April, 1928	2.5	160
May, 1928	15.0	1,076
June, 1928	26.0	4,354
July, 1928	24.0	4,513
August, 1928	24.0	3,490
Complete year	28.0	21,885

	Motor h.p.
Threshing machine	10
Fan for hay-drying	8
Baling press	6
Compressor	4
Hay elevator	3
Hay and sack hoist	1½

Several of the motors are portable, and are used wherever opportunity affords. Lieut.-Col. Lyon says "Electricity on my farm has made crop-drying an economic proposition, thereby eliminating almost entirely the weather factor." The electrical installation was completed in June, 1927, and Table II gives the load conditions which prevailed in each of the months from September, 1927, to August, 1928.

Wireless Short Waves.

An account of investigations of short-wave transmission effects carried out during the past two years in the research laboratories of Marconi's Wireless Telegraph Co., Ltd.

By T. L. ECKERSLEY, B.A., B.Sc.

(*Extracts from a Paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

THE paper afforded the author an opportunity of revising the conclusions he arrived at in a previous paper.* The chief alteration is in the estimated height of the lowest levels of the Heaviside layer in daytime. The accumulation of evidence from the time-lag experiments of Breit and Tuve, and the interference experiments of Appleton and those of Hollingworth (which, incidentally, both give the group time and consequently an over-estimate of the height) have led the author to a revision of the mathematical result by which he obtained from long-wave measurement the effective height of the daylight ionised layer, and in doing so he has found an error which makes the estimated height just double that previously obtained, for instead of the relation $d_s=4h^2/\lambda$, we have $d_s=h^2/\lambda$, making the estimated height lie between 80 km. for summer and 97 to 100 km. for winter.

Previously the value of τ (the mean time between collisions) was found to lie between the limits 0.5×10^{-6} and 0.5×10^{-7} (on the basis of magnetic storm effects). Calculations based on the kinetic theory would imply a height of between 76 and 92 km. for these values of τ, in fairly close agreement with the above, and there is no necessity to make the rather forced previous assumption that the electronic mean free path is some 10 to 50 times greater than that calculated from the normal kinetic theory, on the assumption that the electron may penetrate the outer rings of the molecules without being appreciably deflected. Apparently this effect occurs only in inert gases, such as helium, and is not likely to occur in the upper atmosphere.

With regard to scattering, the glancing angle for transmission, great-circle bearings of the main rays, and the daylight attenuation, the author has found the previous conclusions to be on the whole well-founded. Some modification of the lower wave-length limit for night transmission is required, for it has been found that it depends on the time of the night, and season. Late-night regions behave very differently from early-night regions, thus confirming Appleton's results showing a progressive change in the Heaviside layer during the hours of darkness. The short-wave daylight limit appears to be close to 10 m., but sporadic long-distance transmissions have been observed on wave-lengths shorter than this.

Perhaps the main interest in short-wave transmission, both from the severely practical and theoretical points of view, lies in echo and scattering effects. The author classes them both together, because in the long run the two effects merge into one. From the practical point of view, signal distortion, accompanying echoes and scattering, imposes a severe limitation on high-speed sending and on the newer development of facsimile transmission. Some of the troubles have been overcome by inserting simple biasing devices to sharpen the signals, but even with these devices a limit is set to the speed of transmission of intelligence.

In the author's previous paper on short-wave transmission, reasons were given for supposing that there existed very considerable short-wave scatterings, and in the two years that have passed since then an intensive study of scattering effects has been made in which the original ideas have been abundantly verified. The conclusions are based on directional observations, the *normal* test of scattering being the absence of bearings on suitably designed goniometers.

The causes of signal mutilation are discussed under the following headings:—

(1) *Long echo*, due to the signals arriving by the two different great-circle paths round the world, or by one traversing an extra complete circumference of the world. These effects are easily recognisable, but, taking due account of them, there are, no doubt, other causes of signal mutilation.

(2) *Dispersion.*—Any signal changes shape when travelling through a dispersion medium, such as the Heaviside layer. The amount of mutilation depends on the distance travelled and the closeness of approach of the actual frequency to the critical frequency. Reasons are given for supposing that this effect is negligible on the short-wave band, although there is evidence of dispersion effects on very long waves, *e.g.*, musical x's.

(3) *Quick echo.*—There are cases of quick echo with a lag of the order of 0.01 second which are probably due to long-distance scattering, such as is evidenced by the observations on the local beams, when the source of scattering may be about 2,000 km. away.

(4) *Blurring*, due to multiple scattering, probably occurs mostly on local signals.

(5) *Double or multiple signals*, due to double or multiple paths, produce double or multiple signals with a time interval between signals of the order of 0.01 second. They are brought to light by the picture-transmission results, and are not likely to mutilate morse signals, but affect picture transmission unfavourably.

The effects under the last three headings are likely to contribute to signal mutilation in different proportions, according to the actual conditions of transmission.

The new conception of the Heaviside layer developed in the paper (a complex structure of scattering clouds) necessitates a revision of the usually accepted ray theory. If the scattering in the lower levels of the layer is particularly intense, the emergent ray may be very highly diffused and the emergent energy may entirely lose its ray formation. Order will again be introduced, however, if we make the assumption, which appears unlikely to the author, that the scattering clouds are regularly spaced at a practically constant distance.

Ponte and T. Rocard† have developed a theory on these lines in which the skip effect and minimum wave for transmission are accounted for; it also accounts for a weak, wholly scattered ray within the skip distance, and is based on the fact that if the scattering centres are regularly spaced, then the scattered rays from a thin element of the layer will have a pronounced maximum on the generating lines of a cone of revolution having as an axis the direction of incidence and as half angle of apex the angle θ given by Bragg's law, $\lambda=2d\sin\frac{1}{2}\theta$.

This theory requires a definiteness of structure which, in the author's opinion, is very improbable; moreover, to fit the observations a height of 324 km. for the scattering layer is required, which, in view of our diffusion calculations, also seems very improbable. The effects described may, of course, play a minor rôle in producing skip effects, but the author does not consider them important. However, it is clear that the ray theory may require considerable modifications, not only on account of scattering, and although the optical method of tracing rays has been used with considerable success, in short-wave theory it is well to realise its limitations.

* "Short-Wave Wireless Telegraphy," *Journal* I.E.E., 1927, vol. 65, p. 600.

† *Comptes Rendus*, 1928, vol. 187, p. 942.

Continental Exhibitions.

Brief Notes on the Electrical Sections of the Vienna and Prague Spring Fairs.

(By OUR SPECIAL CORRESPONDENT.)

ALTHOUGH Austria has by no means an inconsiderable electrical industry of her own, it seems that there are now fields of opportunity there for foreign firms, and that quite a number of electrical machines and accessories of certain types can be disposed of readily in Austria. Germany has fully exploited the possibilities of the Austrian market, and it was therefore not surprising to discover that about two-thirds of all the goods shown of an electrical nature at the Vienna Spring Fair, with the exception of wireless gear, were of German origin. The only British firm represented was Messrs. Black & Decker, of Slough.

Vienna Fair.

The Vienna Fair is yearly becoming more important. It differs from the one held at Leipzig,* because the visiting

* Elec. Rev., April 5th, 1929, p. 627.

buyers represent the Balkan States, the Near East, and, of course, Central Europe, to a larger extent, and it is in those countries more than any other in Europe to-day in which the possibilities of electricity in every shape and form still remain to be exploited.

Less heavy machinery was to be seen at Vienna than Leipzig, which was natural, as the requirements of Central European industry are chiefly covered by Germany. A few Austrian manufacturers, however, exhibited motors of from 1.5 to 10 h.p., and a large number of such low-power motors were purchased by artificial-silk weavers in the new "Succession" States, which are equipping very small plant under the protection of tariff walls which invite the installation of new manufacturing businesses. Messrs. Siemens & Halske, who possess cable works at Floriedsdorf, near Vienna, exhibited a new cable machine.

Regarding cold storage, both for the home and provision stores, it was noticeable that the old systems had been completely replaced by more practical and economical installations operated by electricity. For butchers many kinds of machinery were shown, designed to reduce the tedium of hand work in the modern butcher shop; amongst such machines were meat choppers and mincers, and Messrs. Wanderer showed two models of elaborate mincing apparatus, costing £37 and £38, respectively.

The furniture industry was also very well looked after, and amongst the novelties shown was new drilling apparatus which found a ready sale. A special part of the motor-car section included electric lighting systems, but nothing new could be reported on. The toy industry is the latest to make use of electrical appliances, and all manner of novelties are not only amusing, but also educational; at the same time they are perfectly safe in use.

New telephone apparatus was shown by Messrs. Eckstein, who quoted £2 for the article complete. It comprised a novel form of mouthpiece on a stand and an earpiece which is easily fitted over the head and allows the listener perfect freedom of his hands; the mouthpiece itself enables the user to talk at a greater distance from the 'phone than hitherto, which is especially useful on an office desk.

A large number of "dippers" were seen, which are used for boiling quantities of water very quickly. They are made of steel with an ebonite handle and connected by a long flex. Messrs. Winter & Hoffmann showed some, one of which, adaptable for 110, 120, 150 and 220 volts, cost only 3s. 6d.; it can be used, however, for only small quantities of water. One of 800 watts is capable of heating 12 pints, and was quoted at £1 16s.; a still larger one for 20 pints cost £2 10s. Another type, which automatically stops directly the water trough is emptied, was quoted at £4 15s.

Prague Fair.

Manufacturers were well represented, but it was obvious that the excellent state of business in the Czecho-Slovakian electrical factories did not necessitate particular efforts on the part of exhibitors. All stands appeared to have been arranged more with a view to propaganda and prestige than to actual business. The most interesting exhibit was a new alarm arrangement for safes and strong rooms, shown by the Danek Co. The side walls, ceiling, and floor are covered all over with patented plates of an asbestos sheet-iron combination, through which a weak current is constantly circulating, but even a raise of temperature or a mere touch of the plates will interrupt the current and raise the alarm.

Messrs. Patzak & Machacek produce a special motor with a flexible shaft, constructed to facilitate the working of very large objects which cannot very well be brought to the particular machine attached to the motor.

A large number of electrical watches included a local patent "Laplace" clock which can be operated by alternating current and is driven by a very small motor fed with current of which the frequency is regulated by the central clock. The turning momentum is extraordinarily large, and the current consumed is 0.2 watt.

The Eta Co. exhibited a new home bell for from three to ten volts with a transformer mounted inside the bell. The same firm also showed electrical massage apparatus on the rubber-rollers system.

Very little was shown this year in the way of agricultural machinery, which is of such great importance for Czecho-Slovakia and her neighbouring countries. Tractors, pumps, and motors for flour mills especially were seen, but neither novelties nor even minor improvements could be noticed. The Bohemian-Moravian Electro-Technical Works produuced a new accumulator vehicle of the smallest type with two motors fitted to the two rear wheels; the price, however, seemed prohibitive for Continental conditions. Large numbers of vacuum cleaners and domestic electrical apparatus were shown, but aroused far less interest than at Leipzig and Vienna, as the population of the markets which are reached from Prague is still very backward in the use of electrical apparatus at home.

Rumanian Wireless Exhibition Postponed.

The International Wireless Exhibition, arranged to take place at Bucharest from April to June, has been postponed to August 5th-October 31st.—*Reuter* (Bucharest).

Reviews.

Omnibus Lighting and Starting. By J. W. Houghton, A.M.I.E.E. London: The Fanfare Press. Pp. 49; figs. 29. Price 2s. 6d. net.

In view of the great increase which is taking place in this country in the number of motor-'buses and coaches, in all of which electric lighting is being adopted as the standard means of illumination, Mr. Houghton's little work, which is a reprint of a series of articles he recently contributed to one of the motor transport journals, should prove welcome and useful to engineers responsible for their maintenance in good running order.

In his first chapter the author discusses the pros and cons of the two forms of generator used for motor vehicle lighting —the third-brush constant-current and the constant-voltage types, and not only plumps for the latter, but states that it is the one used on over 80 per cent. of the motor-buses in operation in this country. Mr. Houghton then proceeds to deal very exhaustively with suitable installations for various types of 'buses with six- and four-cylinder engines. Diagrams of wiring arrangements are included to elucidate the text, while a method of testing for voltage drop is given. Several pages are devoted to bulbs and lamps.

Although electric engine starters are not yet so universally used on motor-buses as they are on cars, there is a tendency to a greater following of the example, and to those 'bus owners who have not yet adopted engine starters, but have such a departure in mind, the author's remarks on the points which must be observed in the selection of suitable motors and batteries, should prove helpful, both the lead-plate and nickel-iron forms of accumulator being dealt with. Other sections of the little book discuss the anti-dazzle problem, and the best means of coping with it, and also with the matter of driving in fog.

Although judging from the frequent references thereto, the book has been largely produced in the interests of a single make of motor-'bus lighting and starting equipment, it is none the less one that, as we have said, should strongly appeal to the engineers of motor-'bus concerns, as containing in a condensed and convenient form a good deal of useful information on these important questions.

Industrial Carbon. By C. L. Mantell, Ph.D. Industrial Chemical Monographs. Pp. ix+410; figs. 89. London: Chapman & Hall, Ltd Price 21s. net.

This book is one of the series of Industrial Chemical Monographs, and the object with which it was written cannot be better stated than in the following extract from the preface: "the author has attempted to cover the technological applications of elemental carbon, aside from its use as a fuel. The term elemental carbon is applied to mean those substances, materials and products which are either carbon in its elemental form, or which consist entirely of carbon, or whose value in industry is due to the physical and chemical properties of the elemental carbon from which they are made or which they contain." The manifold and ever-increasing applications of carbon in industry are probably hardly realised, and the theoretical chemistry of this field is largely unknown to the makers and users. Progress in the development of industrial carbon is taking place so rapidly that the appearance of this volume is particularly opportune at the present time. So much recent work on carbon has been carried out abroad, and the published accounts are so diffused in periodicals and in the proceedings of foreign scientific societies, that all those in this country interested in carbon will find this volume of considerable interest, which, in addition to other merits, has brought together examples of the most recent practice and fundamental theories from which they are the practical outcome. Practical considerations predominate throughout, but the scientific principles are dealt with in a very thorough and lucid manner. The book is characterised by thoroughness of treatment and excellence of illustration.

The contents of this volume fall into several sub-divisions—the truly elementary forms of carbon, such as diamonds and graphites, with their industrial phases; carbon pigments and fillers, such as carbon black and lamp black; absorbent carbon of the gas, decolouring and metal absorbent types, with which bone black is grouped; the manufactured carbon products, such as electrodes, brushes, &c.; and a reference chapter on the physical characteristics of carbon.

The chapters dealing with natural and artificial graphites hardly do justice to the author's reputation as a specialist; subjects of importance are referred to and dismissed in a way which, to the technical reader, must prove somewhat disappointing. Again, exception must be taken to the statement that "a number of the natural graphites are amorphous"; X-ray analysis has shown them to be perfectly crystalline in structure. Criticism of a volume which contains much descriptive matter is a difficult matter, especially as to complain of incompleteness in a book in which so much information is given may seem a little ungracious. We note, however, that no mention is made of the classical researches of Olbrich and Arsem on the theoretical aspects of the conversion of carbon into graphite. The criticism indicated is the more noticeable since as a whole the book is accurate and shows careful preparation.

The author writes with real enthusiasm when dealing with gas-adsorbent charcoal and decolourising carbons, special reference being made to the applications of charcoal as a means of obtaining high vacua. The employment of activated charcoal has been suggested for the purification of hydrogen and nickel carbonyl for hydrogenation purposes and the purification of ammonia before its catalytic oxidation into nitric acid. The field for activated carbon as a gas adsorbent is very large, and at the present time little explored. An interesting application of activated carbon has been the adsorption of sulphur dioxide from industries, particularly of the metallurgical type, to prevent the destruction of outlying farm and forest lands by the sulphur dioxide in the waste gases. The adsorption by charcoal of electronegative, electropositive and amphoteric substances are greatly affected by the reaction of the medium from which material is being adsorbed. The explanation of the influence of pH may be found in the electrical theory of adsorption and the effect of hydrogen and hydroxyl ions on the size of the charges on particles. Results show that in general the adsorption efficiency of carbons is dependent largely on the difference in electrical potential between the carbon and the adsorbate. The industrial value of carbon might be increased if a carbon were produced which would be active at the permissible pH for the substance to be adsorbed. The electrical properties of carbon can be greatly modified by activation. Perhaps future research will bring forth for decolourising use a carbon which will be positively charged at all pH values. This would be an excellent addition to our present charcoals, since most coloured impurities met in the industries are negatively charged.

The book may be recommended as a critical compendium of information on the subject. In addition to the care which the author has exercised in the preparation of this work, he has supported his effort by embodying contributions from authorities on the various phases of his subject. Dr. Mantell has employed much discrimination in selecting the really useful information from the mass of material available. The volume constitutes not only a *résumé* of the position of the subject up to date, but contains much original matter. The book throughout is exceptionally well annotated with references to existing publications. The volume is a valuable contribution to the literature of the subject.

Railway Electrification and Traffic Problems. By P. Burtt. Pp. vii+197; figs. 23. London: Sir Isaac Pitman and Sons, Ltd. Price 10s. 6d. net.

A technical reviewer is in a somewhat difficult position with regard to this book. It does not pretend to be a technical treatise, and yet certain engineering aspects of the subject must perforce be introduced. The author was formerly deputy general manager of the North-Eastern Railway, and he has written the book as an expansion of his lectures on "Traffic Problems" at the London School of Economics. He is a believer in railway electrification, and is confident that such conversion provides the chief of two or three possible ways whereby the railways can do something to re-establish their financial status and popularity. This belief he substantiates to his own satisfaction—and presumably to that of the uncritical reader who swallows it whole. Yet to the initiated there are certain discordant notes which detract in some measure from a thorough agreement with the author. That electrification of suburban railways enables a regular, rapid and attractive service to be maintained, and that the electrification of main lines results in a speeding-up of traffic and an increase of train weights, can readily be granted. That the conversion from steam to electric haulage is *economically* sound, however, is by no means so conclusively demonstrated, although we gather that this is the author's contention. For example, the Tynemouth electrified zone is shown to have transported twice as many passengers in 1913 as in 1904, at which time a severe tramway competition was being felt; but since 1918 increasing tram and 'bus competition has again reduced the number of railway passengers below the 1904 level! Again, on pp. 69-70, and on p. 120, the author praises the South African Pietermaritzburg-Glencoe electrification as typifying all that is most attractive; but it is depressing to recall the statement published at the end of last year to the effect that the financial results were disappointing. The administration of the Austrian Federal Railways, for financial reasons, also seems to have grave doubts about extending its main-line electrification. Even the Swiss Federal Railways Administration only "estimates with confidence" that financial results will be well.

Several aspects of railway electrification and its psychological effect on passengers are treated fully and convincingly. A good case is made for the relaxation of the rigid rules at present enforced in Great Britain regarding the uneconomically-high standard of railway construction and rolling stock. Using certain Dutch light railways as a model, it is well shown that with present standards light railway construction in this country can scarcely be contemplated, however urgent the need. Road transport is being rapidly developed to deal with the available traffic (although scarcely any mention of this is made in the book), so that in a very short time any hope for light railways will be gone.

Criticism might be levelled at the arrangement of the book. The thread of the argument is apt to be broken by interjected matter, which might have been collected elsewhere with advantage. A number of errors appear, *e.g.*, the percentages of increase of population given on page 165 are all too great by 100, but the most glaring slip is the statement, on page 140, that the Swiss Federal Railways run on 1,500 volts d.c.!

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Climate and Overhead Lines.

Referring to the letter from Mr. G. Molle in your issue of March 29th, the writer refers to the blizzard of March, 1916, and draws attention to the fact that telegraph and telephone lines are much more liable to damage than power lines. Further interesting information on this subject was provided on April 26th, 1917, by Sir William Slingo, at a discussion before the Institution of Electrical Engineers (see Vol. 55 of the I.E.E. *Journal*, No. 267, June, 1917, page 435). Sir William Slingo here draws attention to the fact that in that storm not a single wire weighing 600 lb. per mile was broken down by the weight of snow and ice, or the pressure of wind, whereas wires of 400 lb. per mile were broken in all directions.

N. E. P. Harris.

Trysull, *April 5th*, 1929.

Radio Anode Battery Eliminators.

When changing a system of supply from d.c. to a.c. is it the general rule to change wireless h.t. eliminators for consumers, and, if so, on what terms? A d.c. unit may only be listed at 30s., or so, whereas the cheapest a.c. unit is about £5. As these devices consume but a negligible quantity of electricity, a free exchange seems out of the question. In some towns no allowance has been made for such instruments whatever.

Enquirer.

April 6th, 1929.

[See p. 645 of this issue.—Eds. Elec. Rev.]

Pilot-wire Street Lamp Control.

There are quite a number of statements in Mr. A. C. Johnson's article on "Pilot-wire Street Lamp Control" with which we cannot by any means agree, but there is one particular statement that we really must find time to refute.

In reply to Mr. Johnson's remark ". . . whereas time switches have a very short life and require constant attention for maintenance and repairs," we may say at once that we have been shown records of our own time switches in the test rooms of several undertakings showing that the switches have been on circuit *without cleaning or repairs* continuously for 15, 16, and 17 years!

The huge numbers of our pre-war switches still on circuit are ample evidence of the reliability of a good time switch.

We do not propose at the moment to press the advantages of the wholly automatic electrically-wound time switch, or to deal with several other of Mr. Johnson's remarks, but we feel that the statement referred to above calls for a reply from

Venner Time Switches, Ltd.
(R. C. Graseby, *Managing Director.*)

London, S.W.1, *April 5th*, 1929.

Legal.

Marconi Radio Patent Royalties.

We reported in our issue of March 8th (p. 455) that the hearing of the appeal of Marconi's Wireless Telegraph Co., Ltd., against decisions of the Comptroller-General of Patents in connection with applications by the Brownie Wireless Co. of Great Britain, Ltd., and the Loewe Radio Co., Ltd., was brought to a halt owing to the fact that the Comptroller-General had not made a definite order in the matter. The *Wireless Trader* reports that an order has now been made in which the Marconi Co. is directed to grant a licence to the Brownie Co. enabling it to use the patents in question, with a royalty payment of a minimum of 5s. for the first valve-holder and 2s. 6d. for each subsequent valve-holder fitted in the apparatus produced.

Following upon this the resumption of the hearing of the Marconi Co.'s appeal has been fixed for April 24th.

Alleged "Long-Firm" Frauds.

Charges of obtaining goods by false pretences were preferred against Arthur Stanley Mason, carrying on business as a wireless dealer at 29, Hill Street, Stoke, at Stoke Stipendiary

Court on April 5th. Walter Champ, general dealer, of Shrewsbury Road, Market Drayton, was charged with aiding and abetting in the commission of five offences.

The offences were obtaining wireless receiving sets to the value of £95 from Wingrove & Rogers, Ltd.; electrical accumulators to the value of £58 from the Ever-Ready Co. (Great Britain), Ltd.; 6,000 yards of electric cable, valued at £89 from the Greenwich Cable Works, Ltd.; a wireless receiving set, valued at £71, from R. I. and Varley, Ltd.; and wireless receivers to the value of £6 from the Bedford Electric Radio Co., Ltd. On an alternative count, both Mason and Champ were charged with conspiring together to obtain goods to the value of about £318 from the firms mentioned by false pretences. Mr. H. Taylor, who prosecuted, stated that Mason, by means of false representations, succeeded in obtaining a large quantity of wireless goods between January and February of this year. He took up a lock-up shop, and had billheads printed in the best style, in which he used the title of the "Potteries Electrical Supply." From those premises it was alleged he sent out orders for goods. The offences were all of the "rush" type, orders to the various firms following in rapid succession. As no payment was forthcoming for the goods, inquiries were set on foot, and it was found that Mason had no proper warehouse, but merely received the goods from the victimised firms, and dispatched them to an unknown destination. The suspicions of the police being aroused, investigations were pursued, and it was then discovered that the goods were being received by Champ, who was charged as co-defendant. Mr. Taylor asked for both defendants to be committed for trial at the next Quarter Sessions.

Settlement of Greenock's Claim Against the Admiralty.

A cheque for £50,200 has been paid over to the Town Chamberlain of Greenock by the Admiralty in settlement of the claim made by the Corporation Electricity Department for the recovery of part of the expenditure incurred by the town in installing new plant at the electricity works to meet the demands of the Admiralty for electricity during the war. The claims, it will be recalled, were the subject of protracted litigation, and a settlement was eventually reached for the sum which has now been paid to the Corporation.

A Successful Appeal.

At the Brighton Quarter Sessions, on April 8th, Capt. J. J. Crowe, V.C., appealed against a conviction and a fine of £5 imposed upon him in January for the alleged fraudulent consumption of electricity.

The Recorder, who considered that an inspector had made a mistake, allowed the appeal.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

26,627. "Power-operated vacuum tube construction, and circuit therefor." Arcturus Radio Co. December 24th, 1926. (282,632.)

28,092. "Engine-starting apparatus." A. E. White (Delco-Remy Corporation). October 21st, 1927. (307,981.)

30,336. "Dirigible headlight mechanisms for automobiles." International Controlled Lamp Co. February 23rd, 1927. (285,846.)

31,082. "High-tension ignition devices." British Thomson-Houston Co., Ltd., L. M. T. Bell, and F. E. Smith. November 18th, 1927. (307,955.)

31,277. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). November 21st, 1927. (307,982.)

32,969. "Thermostatic controls for dynamo-electric machines." J. Stone and Co., Ltd., and A. H. Darker. December 6th, 1927. (307,718.)

33,141. "Protective gear for alternating-current systems." H. G. Bell and Associated Electrical Industries, Ltd. December 7th, 1927. (307,957.)

33,359. "Mounting of vibrating reeds, more particularly for use in connection with electromag etic gramophone pick-ups, loud-speakers, and the like." P. Wilson. December 9th, 1927. (307,767.)

33,481. "Mechanical relay for transmitting moving impulses." Siemens-Schuckertwerke Akt. Ges. December 24th, 1926. (282,739.)

33,753. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. December 13th, 1927. (307,857.)

33,614. "Methods of and apparatus for electrolytically depositing metal on tubes." J. Stone & Co., Ltd., C. J. Lyth and F. J. Pike. December 12th, 1927. (307,726.)

33,670. "Automatic or semi-automatic telephone systems and apparatus." Standard Telephones & Cables, Ltd., and J. R. Gould. December 13th, 1927. (307,959.)

33,688. "Thermionic valves." British Thomson-Houston Co., Ltd., and L. J. Davies. December 13th, 1927. (307,812.)

33,699. "Telegraph printers." F. Warburton. December 13th, 1927. (Cognate application 26,162/28.) (307,960.)

33,702. "Electric lamp standards and fitments therefor for use on armchairs and other articles of furniture." N. Evill. December 13th, 1927. (307,774.)

33,711. "Electrically-driven tuning forks or reeds." Muirhead & Co., Ltd., E. S. Heurtley and J. V. Foll. December 13th, 1927. (307,855.)

33,734. "Mounting arrangements for fuse panels and the like as used in telephone exchanges." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. December 13th, 1927. (307,781.)

33,751. "Apparatus for the production of ultra-violet light." A. Eidinow and Hewittic Electric Co., Ltd. December 13th, 1927. (307,961.)

33,752. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. December 13th, 1927. (307,856.)

33,831. "Process for securing good electrical contact with crystalline cuprous oxide." A. K. Croad (Hanovia Chemical & Manufacturing Co.). December 14th, 1927. (307,962.)

33,837. "Electrically-operated typewriting machines." W. A. Maas and P. F. Grinstead. December 14th, 1926. (282,401.)

33,906. "Telephone systems." Associated Telephone and Telegraph Co. January 7th, 1927. (283,201.)

33,975. "Electrically-controlled fluid-pressure apparatus, particularly applicable for operating brakes." A. V. Tomlinson (Westinghouse Air Brake Co.). December 15th, 1927. (307,964.)

34,043. "Insulating materials and methods of production thereof." W. E. Beatty (Bell Telephone Laboratories Inc.). December 15th, 1927. (307,966.)

34,056. "Impulse-transmitting devices for electric switches or make-and-break contacts." A. Green. December 16th, 1927. (307,967.)

34,177. "Loaded electrical conductors." W. S. Smith, H. C. Channon, A. L. Meyers and N. G. R. Partridge. December 16th, 1927. (307,973)

34,235. "Automatic or semi-automatic telephone systems and apparatus." Standard Telephones & Cables, Ltd., and E. P. G. Wright. December 17th, 1927. (307,977.)

34,650. "Radio telegraph, telephone, and like signalling circuits and apparatus." A. E. Watkins. December 21st, 1927. (307,989.)

34,656. "Illuminated signalling devices for road vehicles." E. D. Sykes. December 21st, 1927. (307,991.)

34,928. "Electrical relays." Johnson & Phillips, Ltd., and D. M. Broughton. December 23rd, 1927. (307,995.)

1928.

407. "Electric vehicles." R. Brooks and Metropolitan-Vickers Electrical Co., Ltd. January 5th, 1928. (Addition to 234,571.) (308,002.)

922. "Electric resistance furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. January 11th, 1928. (308,009.)

2,501. "Boxes or cases for electrical apparatus." H. Heath and R. W. Bill. January 26th, 1928. (Cognate application, 30,096/28.) (308,021.)

3,873. "Electric gas-lighters." F. O. Seyd. February 7th, 1928. (308,037.)

4,054. "Electric rotary convertors." J. C. Macfarlane and W. A. Macfarlane. February 9th, 1928. (308,041.)

5,093. "Terminal arrangements for electrical devices." General Electric Co., Ltd., and A. Wardle. February 18th, 1928. (308,052.)

5,589. "Electric motor control systems." General Electric Co., Ltd., and E. H. Croft. February 22nd, 1928. (308,056.)

6,616. "Duplex signalling systems." Siemens & Halske Akt. Ges. March 12th, 1927. (287,048.)

7,492. "Electric speed indicators." G. Mombur. March 10th, 1927. (286,737.)

8,336. "Thermionic generators and the like." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). March 19th, 1928. (308,085.)

8,987. "Telephone sets." Siemens & Halske Akt. Ges. June 25th, 1927. (292,903.)

15,168. "Process for preparing lead electrodes for electric storage batteries." I. G. Farbenindustrie Akt. Ges. May 24th, 1927. (291,032.)

15,389. "Portable electric lamps." J. Downs and Watts, Fincham and Co., Ltd. May 25th, 1928. (308,118.)

15,855. "Lamps, particularly headlights for motor vehicles." P. A. Peters. December 31st, 1927. (303,344.)

18,959. "Metal-vapour rectifiers." Akt. Ges. Brown, Boveri et Cie. June 30th, 1927. (293,046.)

19,511. "Supporting frames for Röntgen-ray photographic apparatus." E. Pohl. July 12th, 1927. (293,796.)

19,702. "Process and mould for casting accumulator grids." W. Petri. July 6th, 1928. (308,131.)

21,867. "Telephone systems." Associated Telephone & Telegraph Co. January 7th, 1927. (Divided application on 283,201.) (294,618.)

23,876. "Electric rotary convertors." J. C. Macfarlane and W. A. Macfarlane. February 9th, 1928. (Divided application on 308,041.) (308,144.)

25,623. "Telegraphic printing systems." Ateliers J. Carpentier. September 30th, 1927. (297,825.)

25,881. "Electric meat and like roaster." J. Seegmuller. September 16th, 1927. (297,117.)

28,480. "Electromechanical amplifier." L. Thurm. October 4th, 1928. (308,156.)

31,289. "Starting device for electromotors equipped with a clutch." K. Kaisser. October 12th, 1927. (Divided application on 303,578.) (307,730.)

1929.

2,535. "Telephone systems." Associated Telephone & Telegraph Co. January 7th, 1927. (Divided application on 283,201.) (304,702.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

MARCH 27th.

Busy Bee. No. 497,618. Class 6. Electric vacuum cleaners.—Drake and Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.

Charide. No. 495,130. Class 8. Radio-telephonic instruments and gramophones.—R. May, 48, Canning Road, Croydon.

Igranophone. No. 499,862. Class 8. Radio-telephonic apparatus in combination with gramophones and parts thereof.—Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

Okoscope (lettering and design). No. 499,913. Class 8. Electrical resistances, fitted switchboards, and electric accumulators (not for medical purposes), &c.—Okoscope & Camera Developments, Ltd., 10, Lancaster Place, W.C.2.

Twelco. No. 496,912. Class 13. Electric lamps (ordinary).—J. M. Fairhurst, trading as the Western Electric Lamp Co., 122, Royal Exchange, Manchester.

Eta. No. 497,286. Class 13. Electrical switches, fusible cut-outs, and contact plugs.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Projectolux, No. 499,539, and Intensolux, No. 499,540. All goods in Class 13. —Benjamin Electric, Ltd., Tariff Road, Tottenham, N.17.

Dakol. No. 497,629. Class 15. Glass.—Dakol Electric, Ltd., Byron Street, Newcastle-on-Tyne.

Isco. No. 498,269. Class 50. Mouldable compositions and articles made therefrom for electrical insulating purposes.—W. T. Henley's Telegraph Works Co., Ltd., 11, Holborn Viaduct, E.C.1.

APRIL 3rd.

Distaset. No. 497,574. Class 8. Radio-telephonic apparatus.—Truphonic Co., Ltd., 121-129, Rosebery Avenue, E.C.1.

Osram. No. 498,869. Class 8. Apparatus and parts thereof for use in connection with television and telegraphy.—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Polyfar. No. 499,193. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof, &c.—Polyphonwerke Gesellschaft, Berlin. British representative: F. W. Golly, 3, John Street, Bedford Row, W.C.1.)

Gothic. No. 500,032. Class 8. Loud speakers.—M.P.A. Wireless, Ltd., 62, Conduit Street, W.1.

Kelstom Wireless Specialities (lettering and design). No. 499,987. Class 8. Instruments and apparatus for use in connection with radio-telephony and telegraphy.—Kells & Thompson, 100, George Street, Portman Square, W.1.

Sunbeam. No. 498,582. Class 18. Electric lighting, power and ignition sets for cycles and motor-cycles.—John Marston, Ltd., Paul Street, Wolverhampton.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABENHALL.—School (£7,450), for Gloucestershire E.C.; education architect, Gloucester.

ARDROSSAN.—Post office; architect, H.M. Office of Works, 122, George Street, Edinburgh.

AUDLEY.—School (£30,000), for Lancs. E.C.; Woof, Cronshaw & Sons, builders, Blackburn.

BAILDON.—Housing scheme (30), for the U.D.C.; James H. Hall & Son, architects, 19, Exchange Buildings, Market Street, Huddersfield.

BARKING.—Factory, Wakering Road; H. Brown & Son, Ltd.

BATH.—Conversion of hospital into technical college (£50,000) for the City E.C.; director of education.

BECKENHAM.—Electricity showrooms and offices, Rectory site, for the U.D.C.; Lanchester, Lucas & Lodge, architects, 19, Bedford Square, W.C. Nurses' hostel, Beckenham and Penge Maternity Home; U.D.C. surveyor.

BENFLEET.—Extensions, South Benfleet School (£4,500); Essex county architect.

BEXHILL.—Additions to Collington Rise School; T. L. McCormick.

BILLINGHAM (Stockton-on-Tees).—Additional 500 houses, for the U.D.C.; surveyor.

BIRKENHEAD.—Rehousing scheme, Whetstone Lane; borough engineer.

BIRMINGHAM.—Extensions of Hartfield Crescent Council School (£19,500); chief education officer, Education Department. Baths, Sparkhill (£37,000); baths manager.

BISHOPS STORTFORD.—Factory, Hockerill Street, for the United Match Industries, Ltd.

BOURNEMOUTH.—Theatre, for the Bournemouth Dramatic and Orchestral Club (£15,000); secretary. West Undercliff promenade extension (£37,500); borough engineer.

BRADFORD.—Proposed extensions, College of Arts and Crafts (£8,500); city architect, Town Hall.

BRISTOL.—School. Portway (800 places), for the City E.C.; Holbrow & Oaten, architects, 22, Clare Street.

CAMBRIDGE.—Café, restaurant, ballroom, &c., for G. P. Hawkins, Ltd., Dorothy Café.

CHEADLE AND GATLEY.—Housing scheme (56), for the U.D.C.; surveyor.

CHELTENHAM.—Shop and warehouse, Libertus Road; Gloucester Co-operative Society. Nurses' home, Workhouse, Swindon Road; Board of Guardians. 150 houses, Whaddon Road and Gloucester Road; Mr. Malvern, architect for Corporation.

CLOWN.—Housing scheme (42), Whitwell, for the R.D.C.; J. Haslam, architect, Ryton Chambers, Bridge Street, Worksop.

CRANFORD.—Aerodrome; Blackwell & Meyer, builders, Erith Road, Bexley Heath.

DARTFORD.—Block of offices and shops, for J. B. Walton; G. E. Burgess, architect; Blackwell & Meyer, builders, Erith Road, Bexley Heath.

DEWSBURY.—Girls' secondary school, for the governors of Wheelwright Grammar Schools; clerk.

EASTBOURNE.—Aerodrome; borough engineer. Alterations, New Central Cinema, Seaside Road, for Central and Eastern Cinema, Ltd.; S. Ford, architect.

GLASGOW.—80 houses, Shettleston and Tollcross; housing director and trade contractors.

GRAVESEND.—Development, Golf Links Estate, for Gravesend Land Co.; L. F. L. Bridgland. Alterations and additions, Milton Road; Gravesend Co-operative Society, Ltd.

HAMILTON.—Police Court house, with electrical work, for Lanarkshire C.C.; P. C. Smith, architect, District Offices, Hamilton. (Applications for schedules by April 10th.)

HARLESCOTT.—School (350 places), for Salop E.C.; W. H. Pendlebury, secretary, County Buildings, Shrewsbury (returnable deposit of £2 2s.).

KEIGHLEY.—Extension of School of Art; E. Ratcliffe, director of education.

KINGSTON-ON-THAMES.—Additional 94 houses for the T.C., borough surveyor.

LANARKSHIRE.—198 houses for District Committee of Lower Ward of Lanarkshire; the county clerk, Hamilton. Justice of Peace Court-house in Hamilton (electric lighting); P. C. Smith, architect, District Offices, Hamilton.

LEICESTER.—Secondary school (£45,000); director of education.

LINCOLN.—Additional 32 houses, St. Giles' Estate, for the T.C.; S. C. Baggott, city engineer (returnable deposit of £1 1s.).

LONDON (Ilford, E.).—Factory extensions, Vicarage Lane; Plessey Co., Ltd.

(Abbey Wood, S.E.).—Billiard hall and shops, Abbey Wood Road, for W. A. Gallier.

(Lambeth, S.E.).—Buildings for St. Thomas Church, Westminster Bridge Road and Pearman Street; R. E. Smith. Partial reconstruction General Lying-in Hospital, York Road; governors. 100 flats, Cottington Street (£51,000); borough engineer.

(Southwark, S.E.).—School for 280, Pastors' College, Newington Butts; Spurgeon's Tabernacle trustees.

MARGATE.—Secondary school, for Kent E.C.; E. Salter Davies, director of education, Sessions House, Maidstone.

MIDDLESBROUGH.—Additional housing schemes (666), for the T.C.; S. E. Burgess, borough engineer. Municipal aerodrome, Marton Road, for the T.C.; borough engineer.

MOTHERWELL.—Extensions at silk factory, for Anderson and Robertson; the manager.

NORTHERN IRELAND (Cavan).—Additions to Surgical Hospital, for County Board of Health; T. J. Brady, secretary, County Home.

NORTHWICH.—Houses (100), for Brunner, Mond & Co., Ltd.

PETERBOROUGH. — Municipal buildings and shops (£186,000), for the T.C.; John Thompson & Sons, Ltd., builders.

PLYMOUTH.—Houses (70), at Laira, for the Great Western (Plymouth) Housing Society, Ltd.; T. Alwyn, Ltd., architects, 6, Cathedral Road, Cardiff.

ROMFORD.—Intermediate school (£28,193), for Essex E.C.; J. Stuart, county architect, Chelmsford. Hospital block and extensions to nurses' home, and premises for 50 tuberculosis patients, for the B.G.; clerk.

ROTHERHAM.—Extension of refrigerator manufacturing works (Thos. Hall & Son, Ltd.); for British Automatic Refrigerators, Ltd., 82, Victoria Street, London, S.W.1.

SALTBURN.—Dance hall; secretary, Saltburn Pier Co.

SHEFFIELD.—Shear factory, Cross Smithfields; D. Reynolds. Social institute, Manor Estate (£5,000); city architect.

SHREWSBURY.—Senior schools (£27,500), for the Borough E.C.; Bernard Widdows, architect, Derby; Walter Danks, builder, Eccleshall, Staffs.

SIDMOUTH (Devon).—Extensions to hospital (£9,000), for the Committee; Mr. Moore, architect.

SLEAFORD.—40 houses, various sites; U.D.C. surveyor.

SMETHWICK.—Cinema, Gaumont British Picture Corporation, Ltd. Extensions, Dale Street Works; E. Clarke and Co. Boxing booth and assembly hall, Union Street; H. Higgins.

SOUTHEND-ON-SEA.—Block of shops and flats, Hamlet Court Road; Arthur H. Holmes, architect, 99, High Street.

SOUTHPORT.—Re-erection (after fire) of The Palladium (electrically equipped); W. Hughes, manager (over £60,000).

STOCKTON-ON-TEES.—Houses (38), Wolviston, for P. Duffy, Norton.

TAUNTON.—Housing scheme (38), for the R.D.C.; surveyor.

TWICKENHAM.—38 houses, Red House Estate, Heath Road; Messrs. A. Mason & Co.

WAREHAM (Dorset).—Re-erection (after fire) of printing works, West Street (electrically equipped), for F. T. Symonds.

WELCOMBE (Bideford, Devon).—Re erection of Welcombe House, residence of Mr. Gifford, South Hole (£15,000).

WELWYN GARDEN CITY.—Post office, Howardsgate, for H.M. Office of Works, King Charles Street, London, S.W.

WISHAW.—Additions at Wishaw Public School, for Education Authority of the County of Lanark; clerk of the Authority, Hamilton.

WOTTON ST. MARY.—School (£6,945), for Gloucestershire E.C.; John Simmons, builder, Gloucester.

YORK.—Estate development, Millfield Lane and Tang Hall Lane; Millfield Estate Co., Ltd. Additions, The Shambles; Dean and Chapter of York. Alterations, Technical Institute, Clifford Street; F. Shepherd & Son, Ltd. Additions, Central Hostel, Micklegate, Y.W.C.A.